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Aims of the Journal: Journal of Regional Socio-Economic Issues (JRSEI) is an international multidisciplinary refereed journal the purpose of which is to present papers manuscripts linked to all aspects of regional socio-economic and business and related issues. The views expressed in this journal are the personal views of the authors and do not necessarily reflect the views of JRSEI journal. The journal invites contributions from both academic and industry scholars. Electronic submissions are highly encouraged (mail to: **gkorres@geo.aegean.gr**).

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Editorial Note

The EU needs to pay more attention to the policies toward growth, development, competitiveness and the regional-cohesion. A new generation of policies have to overcome the limitations and failures of past experiences, such as collusive practices between political and economic power, heavy bureaucracy, lack of accountability and obstacles of entrepreneurship. They have to be creative and selective, with decision-making mechanisms that are more democratic and inclusive of different social interests, pulling out of the current crisis. The politics behind such a new departure has to be based on a wide social consensus over the distribution of the productivity and efficiency gains deriving from new technologies and socio-economic activities.

This special issue, Volume 6, June 2016, based on selected papers regarding economic crisis and the socio-economic consequences. More specifically, this special issue includes the following reviewed papers:

- Frequency of Childhood Obesity in Primary School Students of Municipality of Karpenisi
- (by Gketsios Ioannis, Karagouti Vasileia, Belitsi Vasiliki, and Tonia Vassilakou)
- Program Facing Childhood Obesity through Improvement of Nutrition and Enhancement of Physical Activity in Elementary School' s Students Aged 11-12 Years Old (by Belitsi Vasiliki and and Pastroma Konstantina)
- Using Graphic Calculator in Mathematical Teaching: Perceptions of Secondary Education Teachers (by Lemonia Boutskou)
- The Effects of Economic Crisis in Greece (by Tsioni Irene**)**
- The Impact of Economic Crisis on the Performance of Greek Companies (by Themelidou Maria**)**
- The Greek Economic Crisis: Lessons and Prospects (by Mpanteli Rafaela – Georgia)

Furthermore, this special issue explores and studies various dimensions of the socio-economic issues. This special issue considers both an economic and social perspective to increase the information base and derive broader conclusions about the social consequences of the economic crisis, with this issue being of particular research relevance because evidence shows that even though economic crisis has been widely analyzed with respect to economic consequences, yet little attention has been paid to the evaluation of social consequences.

The authors of this special issue hereby declare that all papers included in this special issue are the result of their own actual work and originally authored by them, except explicitly stated otherwise in the text. Authors declare to be aware of and understand the journal's policy on plagiarism and except where states otherwise by reference or acknowledgment, the papers presented are entirely their own and any due references used are being clearly indicated and have been provided on all supporting literatures and resources.

The views expressed in this journal are the personal views of the authors, remain under their sole responsibility, and do not necessarily reflect the views of JRSEI journal.

The Editor,

Professor Dr. George M. Korres

Frequency of Childhood Obesity in Primary School Students of Municipality of Karpenisi

Abstract:

Obesity among children and young people has become a modern epidemic.

Purpose: The purpose of this study was the evaluation of the body mass index (BMI), by age and sex, of the students of elementary schools of the Karpenisi town.

Material and Methods: The sample of the study consisted of 239 students (boys and girls) of A, C, F classes of the 1st, 2nd, 3rd and 4th primary schools of the Karpenisi town in the region of Evritania during the school year 2011-2012 . To determine body mass index (BMI) measurements of weight and height were accomplished in the schools. The calculation of BMI was done by correlating weight (Kg) / height^2 (m^2). Within schools also became the collection of demographic data such as age, gender and ethnicity. The children were classified according to age and gender: a) Children within normal weight limits, b) Overweight children, c) Obese children, according to internationally accepted BMI limits for assessing body weight in children aged 2-12 years. The data were coded and entered into the computer program (SPSS 17.0). For the statistical analysis used appropriate statistical package and control x^2 applied (alternatively Fischer test for small sample size). The statistical significance was set at p<0,05. For the presentation of the results, the median value d and interquartile range (IQR) were used.

Results: The percentage of overweight and obese boys was **14%** and **7.4%** and of the girls **15.2%** and **6.8%** corresponding in the total sample. (according to the percentiles of IOTF). In boys, the peak frequency of obesity occurs at the age of 11.5 years, while in girls at the age of 8 years.

Conclusions: The problem of obesity exists and pin-points a significant percentage of pupils, particularly at critical periods of onset of puberty in both sexes. The findings confirm the reservations about the applicability of the proposed development curves by the Ministry of Health.

Keyowrds: Childhood Obesity, Development Curves, Nutrition, Epidemiology, Greek students.

Gketsios Ioannis[1],Karagouti Vasileia[2], Belitsi Vasiliki[3], and Tonia Vassilakou[4]

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1. Introduction

The financial crisis in Europe has posed major threats and opportunities to health. The economic crisis that has engulfed Europe since 2008 has raised concerns about the health of ordinary people (Karanikolos,2013).

Unemployment is associated with increased unhealthy behaviors and affects mental health, leading to increased psychological and behavioral disorders and increased risk of psychosomatic diseases and suicides (Ungvary, 1999).

Poor health in unemployed groups is partly a result of reduced financial resources, because loss of income can lead to poor nutrition. (Creed, 1998).

The word obesity describes the disproportional increase in weight compared with the height of the individual and the expected value for sex and age. Obesity among children and young people has become a modern epidemic. Childhood obesity is considered a precursor of adult obesity and accompanied by a multitude of effects on the life of the child and adolescent, and later the adult, as it constitutes a significant and independent risk factor for the association of morbidity and mortality from cardiovascular diseases.

Therefore, a series of hormonal, psychological and social factors contributes to the acquisition of excess fat in the body.

2. Requirements of children-adolescents in energy and nutrients

2.1 Energy needs

The energy requirements of a child should at least accomplish the minimum needs, which depend on the composition of his body, weight, height and physical activity. The average energy consumption for growth roughly determined by:

• Children 4-6 years: 100-110 calories per kilogram of body weight.

• Children 7-10 years: 70-100 calories per kilogram of body weight (for children with intense physical activity above prices should be increased).

• Adolescence: Generally in girls the daily energy needs range from 2000 - 2200 kcal / day, while the boys range from 2500 - 3000 kcal / day, and depending on physical activity (FNB 2010, Wofford 2008).

For the classification of children according to their body weight the following are used:

• The new growth curves (Chroussos et al 2003) of Child Health Institute for Greek children aged 6-18 years, which replaced the earlier 1978 (Institute of Child Health).

• The growth curves of children 5-19 years of WHO 2007.

• Percent positions (25th and 30th) of the International Obesity Task Force (IOTF).

3. Material and Method

3.1 Purpose

The purpose of this study was to record and evaluate the findings resulting from the determination of BMI, according to age and sex of pupils in primary schools of Karpenisi town in the region of Evritania regarding the frequency of obesity. The objective was to give an indicative picture of the incidence of childhood obesity and overweight in the above sample with the ultimate aim of designing interventions at primary health care level.

3.2. Sample

The sample were students of A, C, F grades of 1st, 2nd, 3rd and 4th primary school of Karpenisi town in Evritania area during the school year 2011-2012. It is noted that the Municipality of Karpenisi is a municipality of the region of Central Greece, which is a mountainous municipality, on the southwest side of Velouchi at an altitude of 960 meters.

The sample was 239 children (16 children of foreign families) of both sexes, aged 6-12 years (response rate 79%).

To determine body mass index (BMI) measurements were made to the children in the schools the first two hours. Permission was obtained from the Pedagogical Institute and the data collection was done after informing the parents and giving their written approval.

Measurements were made with the following instruments:

- Electronic balance CHARDER GEDP-3
- Height Counter Haimeisornad GM 200 P

The data collection was done by the investigator, it was anonymous and confidential and included:

- The weight of the body.
- The height of the body.
- Calculation of the BMI using the formula Weight (Kg) / height^2 (m^2).
- Demographical data, such as age, gender and ethnicity.

The children were classified according to age and gender to:

- Children within normal weight limits.
- Overweight children.
- Obese children.

according to internationally accepted BMI limits for assessing body weight in children aged 2-12 years.

Table 1 Schools Karpenisi City

	1st School	2nd School	3rd School	4th School	Total
Measured A, C, F,classes	70	75	50	44	239
Total of children A', C', F' Class	77	101	66	57	301
Percentage of participation (%)	70/77 (90,9)	75/101 (74,3)	50/66 (75,7)	44/57 (77,2)	239/301 (79,4)

Self processed

Totally per class were measured:

Table 2 Total number of participants per class.

	1st School	2nd School	3rd School	4th School	Total
A΄ Class	22	24	20	16	82
C΄ Class	25	22	15	19	81
F΄ Class	23	29	15	9	76
Total	70	75	50	44	239

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3.3 Processing of data

The data were coded and entered into the computer program (SPSS 17.0). For the statistical analysis of the data used appropriate statistical package and control x^2 (alternatively Fischer test for small sample) was applied. The statistical significance was set at $p < 0,05$. For the presentation of results used the median d and interquartile

range (IQR). Obesity is defined in three ways: a) based on the 85th and 95th position in the study sample, b) based on percentiles (25th and 30th) of the International Obesity Task Force (IOTF) and c) with the proposed growth curves for Greek children of the Ministry of Health.

4. Results

Tables 3 and 4 presenting the results on the distribution of weight, height and BMI in boys and girls of the sample by age.

Table 3. Distribution of height, weight and BMI in the boys of the sample by age.

GENDER	AGE			HEIGHT	WEIGHT	BMI
BOYS	6,00	N		15	15	15
		Percentiles	25	1,23	24,00	14,00
			50	1,37	30,00	16,00
			75	1,45	40,00	18,00
	6,50	N		21	21	21
		Percentiles	25	1,29	24,50	14,00
			50	1,33	29,00	15,00
			75	1,42	33,50	17,50
	7,00	N		8	8	8
		Percentiles	25	1,26	25,25	14,50
			50	1,35	31,50	16,00
			75	1,42	36,00	19,25
	8,00	N		14	14	14
		Percentiles	25	1,31	26,25	15,00
			50	1,35	34,50	17,50
			75	1,44	38,50	19,00
	8,50	N		22	22	22
		Percentiles	25	1,22	25,00	14,75
			50	1,32	28,50	15,00
			75	1,39	32,50	17,25
	9,00	N		7	7	7
		Percentiles	25	1,18	23,00	15,00
			50	1,30	26,00	15,00
			75	1,39	34,00	17,00
	11,00	N		12	12	12
		Percentiles	25	1,23	23,25	15,00
			50	1,36	29,50	16,00
			75	1,51	43,25	17,75
	11,50	N		15	15	15
		Percentiles	25	1,23	24,00	15,00
			50	1,42	32,00	16,00
			75	1,60	47,00	21,00
	12,00	N		7	7	7
		Percentiles	25	1,22	23,00	14,00
			50	1,32	27,00	15,00
			75	1,33	31,00	18,00

Self processed

*** Boys / Height: Age** 6.00 years, **Median (d)** = 1,37, International Quartile Ratio **(IQR)** (1,23- 1,45)

Age 6.50 years**: d** = 1,33, **IQR** (1,29 - 1,42)
Age 7.00 years: **d** = 1,35, I**QR** (1,26 - 1,42)
Age 8.00 years: **d =** 1,35, **IQR** (1,31 - 1,44)
Age 8.50 years: d = 1,32, **IQR** (1,22 - 1,39)
Age 9.00 years: d = 1,30, **IQR** (1,18 - 1,39)
Age 11.00 years: d = 1,36, **IQR** (1,23 - 1,51)
Age 11.50 years: d = 1,42, **IQR** (1,23 - 1,60)
Age 12.00 years: d = 1,32, **IQR** (1,22 - 1,33)

Boys / Weight: **Age** 6.00 years, **Median (d)** = 30, **IQR** (24 - 40)

Age 6.50 years: **d =** 29, **IQR** (24,50 - 33,50)
Age 7.00 years: **d =** 31,50, **IQR** (25,25 - 36)
Age 8.00 years: **d =** 34,50, **IQR** (26,25 - 38,50)
Age 8.50 years: **d =** 28,50, **IQR** (25 - 32,50)
Age 9.00 years: **d =** 26, **IQR** (23 - 34)
Age 11.00 years: **d =** 29,50, **IQR** (23,25 - 43,25)
Age 11.50 years: **d =** 32, **IQR** (24 - 47)
Age 12.00 years: **d =** 27, **IQR** (23 - 31)

Boys / **BMI**: **Age** 6,00 years: **Median (d) =** 16, (**IQR**) (14 - 18)

Age 6.50 years: **d =** 15, **IQR** (14 -17,5)
Age 7.00 years: **d =** 16, **IQR** (14,50 -19,25)
Age 8.00 years: **d** = 17,50, **IQR** (15 -19)
Age 8.50 years: **d =** 15, **IQR** (14,75 -17,25)
Age 9.00 years: **d** = 15, **IQR** (15 -17)
Age 11.00 years: **d** = 16, **IQR** (15 -17,75)
Age 11.50 years: **d** = 16, **IQR** (15 - 21)
Age 12.00 years: **d =** 15, **IQR** (14 -18)

Table 4. Distribution of height, weight and BMI in the girls of the sample by age.

GENDER	AGE			HEIGHT	WEIGHT	BMI
GIRLS	**6,00**	N		10	10	10
		Percentiles	25	1,29	25,75	15,00
			50	1,35	30,00	16,00
			75	1,39	35,00	20,50
	6,50	N		19	19	19
		Percentiles	25	1,24	24,00	15,00
			50	1,34	29,00	16,00
			75	1,38	39,00	20,00
	7,00	N		8	8	8
		Percentiles	25	1,24	24,25	14,25
			50	1,32	29,00	15,50
			75	1,51	34,00	17,00
	8,00	N		13	13	13
		Percentiles	25	1,29	27,00	16,00
			50	1,36	37,00	18,00
			75	1,52	44,50	20,00
	8,50	N		24	24	24

		Percentiles	25	1,19	22,00	15,00
			50	1,34	26,50	15,00
			75	1,41	35,75	17,00
	9,00	N		4	4	4
		Percentiles	25	1,20	22,00	14,50
			50	1,26	24,50	16,50
			75	1,34	33,75	18,50
	11,00	N		14	14	14
		Percentiles	25	1,29	26,00	14,00
			50	1,51	35,50	16,50
			75	1,56	44,25	17,75
	11,50	N		23	23	23
		Percentiles	25	1,28	24,00	14,00
			50	1,47	40,00	18,00
			75	1,54	48,00	19,00
	12,00	N		3	3	3
		Percentiles	25	1,50	41,00	17,00
			50	1,52	43,00	18,00
			75	1,58	49,00	21,00

Self processed

** **Girls / Height**: **Age** 6.00 years, **Median (d)** = 1,35, International Quartile Ratio **(IQR)** (1,29- 1,39)

Age 6.50 years: **d =** 1,34, **IQR** (1,24 - 1,38)
Age 7.00 years: **d** = 1,32, **IQR** (1,24 - 1,51)
Age 8.00 years: **d** = 1,36, **IQR** (1,29 - 1,52)
Age 8.50 years: **d** = 1,34, **IQR** (1,19 - 1,41)
Age 9.00 years: **d** = 1,26, **IQR** (1,20 - 1,34)
Age 11.00 years: **d** = 1,51, **IQR** (1,29 - 1,56)
Age 11.50 years: **d** = 1,47, **IQR** (1,28 - 1,54)
Age 12.00 years: **d** = 1,52, **IQR** (1,50 - 1,58)

Girls / Weight: **Age** 6.00 years, **Median (d)** = 30, **IQR** (25.75 - 35)

Age 6.50 years: **d** = 29, **IQR** (24 - 39)
Age 7.00 years: **d** = 29, **IQR** (24,25 - 34)
Age 8.00 years: **d** = 37, **IQR** (27 - 44,50)
Age 8.50 years: **d** = 26,50, **IQR** (22 - 35.75)
Age 9.00 years: **d** = 24.50, **IQR** (22 - 33.75)
Age 11.00 years: **d** = 35.50, **IQR** (26 - 44,25)
Age 11.50 years: **d** = 40, **IQR** (24 - 48)
Age 12.00 years: **d =** 43, **IQR** (41 - 49)

Girls / BMI: **Age** 6,00 years: **Median (d)** = 16, **IQR** (15 - 20,50)

Age 6.50 years: **d** = 16, **IQR** (15 - 20)
Age 7.00 years: **d** = 15,50, **IQR** (14,25 -17)
Age 8.00 years: **d** = 18, **IQR** (16 -20)
Age 8.50 years: **d** = 15, **IQR** (15 -17)
Age 9.00 years: **d** = 16,50, **IQR** (14,50- 18,50)
Age 11.00 years: **d** = 16,50, **IQR** (14 -17,75)
Age 11.50 years: **d** = 18, **IQR** (14 - 19)
Age 12.00 years: **d** = 18, **IQR** (17 - 21)

The percentage of overweight boys was **14%,** while the obese was **7.4%** in the whole sample.

The percentage of overweight girls was **15.2%,** while the obese was **6.8%** in the whole sample (according to the percentiles of IOTF).

Table 5. Distribution of overweight and obese boys of the sample by age (according to the percentiles of IOTF).

BOYS N=121	**Overweight**		**Obese**	
Age	N	%	N	%
6	2	11,8	2	22,2
6,5	3	17,6	2	22,2
7	1	5,9	1	11,1
8	3	17,6	1	11,1
8,5	1	5,9	1	11,1
9	1	5,9	0	0,0
11	2	11,8	0	0,0
11,5	4	23,5	2	22,2
12	0	0,0	0	0,0
Total	17	100,0	9	100,0
Percentage	17/121=14%		9/121=7,4%	

Self processed

Table 6. Distribution of overweight and obese girls of the sample by age (according to the percentiles of IOTF).

GIRLS N=118	**Overweight**		**Obese**	
Age	N	%	N	%
6	1	5,5	3	37,5
6,5	4	22,6	3	37,5
7	1	5,5	0	0,0
8	5	27,7	1	12,5
8,5	2	11,1	0	0,0
9	1	5,5	0	0,0
11	3	16,6	0	0,0
11,5	1	5,5	1	12,5
12	0	0,0	0	0,0
Total	18	100,0	8	100,0
Percentage	18/118=15,2%		8/118=6,8%	

Self processed

Table 7. Distribution of overweight and obese boys and girls of the sample by age and sex (according to the percentiles of IOTF).

Self processed

Total number of children N=239	**Overweight**		**Obese**	
Age	N	%	N	%
6	3	8,6	5	29,5
6,5	7	20	5	29,5
7	2	5,7	1	5,8
8	8	22,9	2	11,7
8,5	3	8,5	1	5,8
9	2	5,7	0	0,0
11	5	14,3	0	0,0
11,5	5	14,3	3	17,7
12	0	0,0	0	0,0
Total	35	100,0	17	100,0
Percentage	35/239=14,6%		17/239=7,1%%	

Table 8 presents the distribution of overweight and obesity boys and girls by age, according to the percentiles of the sample

Table 8. Distribution of overweight and obese boys and girls according to the percentiles of the sample of this study.

Age	**Boys**					**Girls**				
	N	85th position BMI	Overweight (%)	95th position BMI	Obese (%)	N	85th position BMI	Overweight (%)	95th position BMI	Obese (%)
6	15	19,6	6,7	24	6,7	10	20,5	10	25	10
6,5	21	19,0	19,1	20,9	0	19	21,00	10,6	28,00	5,3*
7	8	20,65	12,5	21,00	0	8	18,95	0	20,00	**12,5***
8	14	19,00	21,4	23,00	7,1	13	21,80	7,7	23,00	**7,7**
8,5	22	19,55	9	22,85	4,5	24	18,00	12,5	19,00	8,3
9	7	18,60	14,3	19,00	0	4	19,00	25,0	19,00	0

11	12	22,05	8,3	23,00	8,3	14	20,75	14,2	22,00	7,1
11,5	15	20,40	26,7	20,50	0	23	21,00	12,9	21,00	0
12	7	18,00	0	18,00	0	3	21,00	0	21,00	0
X^2, p<0,05						**X^2, p<0,05**				***p<0,01**

Self processed

Table 9 presents the distribution of overweight and obese boys and girls by age, according to the percentiles of the IOTF.

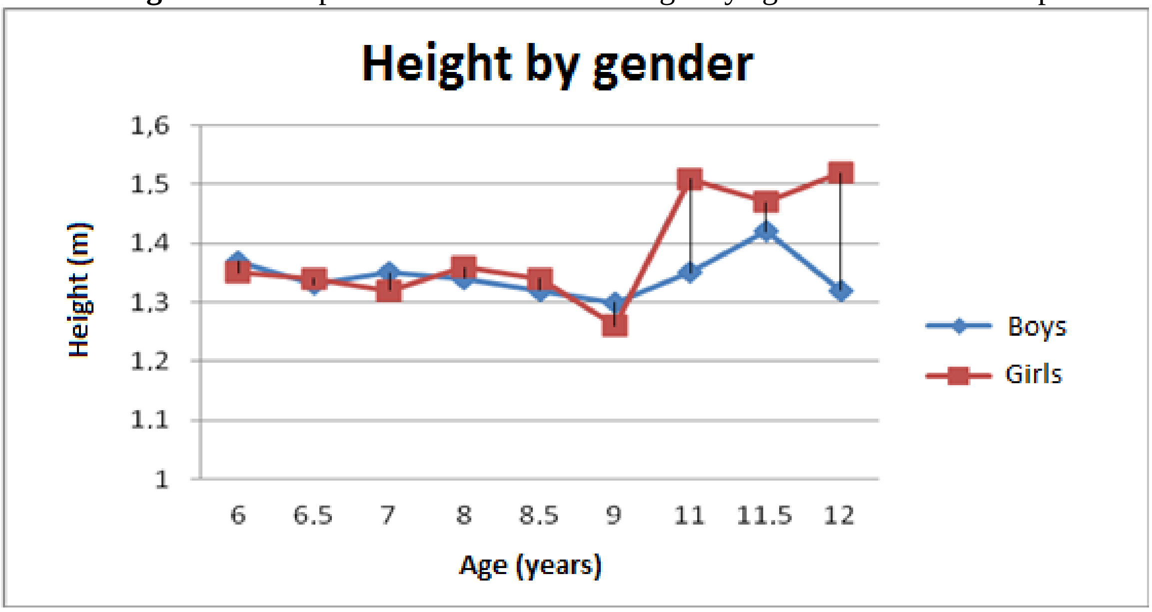
Table 9. Distribution of overweight and obese boys and girls according to the percentiles of the IOTF.

Age	**Boys**					**Girls**				
	N	25th position BMI	Overweight (%)	30th position BMI	Obese (%)	N	25th position BMI	Overweight (%)	30th position BMI	Obese (%)
6	15	17,6	13,4	19,8	13,4	10	17,3	10	19,7	**20**
6,5	21	17,7	14,3	20,2	9,6	19	17,5	21	20,1	15,8
7	8	17,9	12,5	20,6	12,5*	8	17,8	12,5	20,5	0
8	14	18,4	21,5	21,6	7,1	13	18,3	30,8	21,8	**15,4**
8,5	22	18,8	4,5	22,2	4,5	24	18,7	8,3	22,2	0
9	7	19,1	14,3	22,8	0	4	19,1	25,0	22,8	0

11	12	20,6	16	25,1	0	14	20,7	24,3	25,4	0
11,5	15	20,1	26,6	21,2	**14,3**	23	21,2	4,3	26,1	4,3
12	7	21,2	0	26,0	0	3	21,7	0	26,7	0
X^2, p<0,05					***p<0,01**	**X^2, p<0,05**				**p<0,05**

Self processed

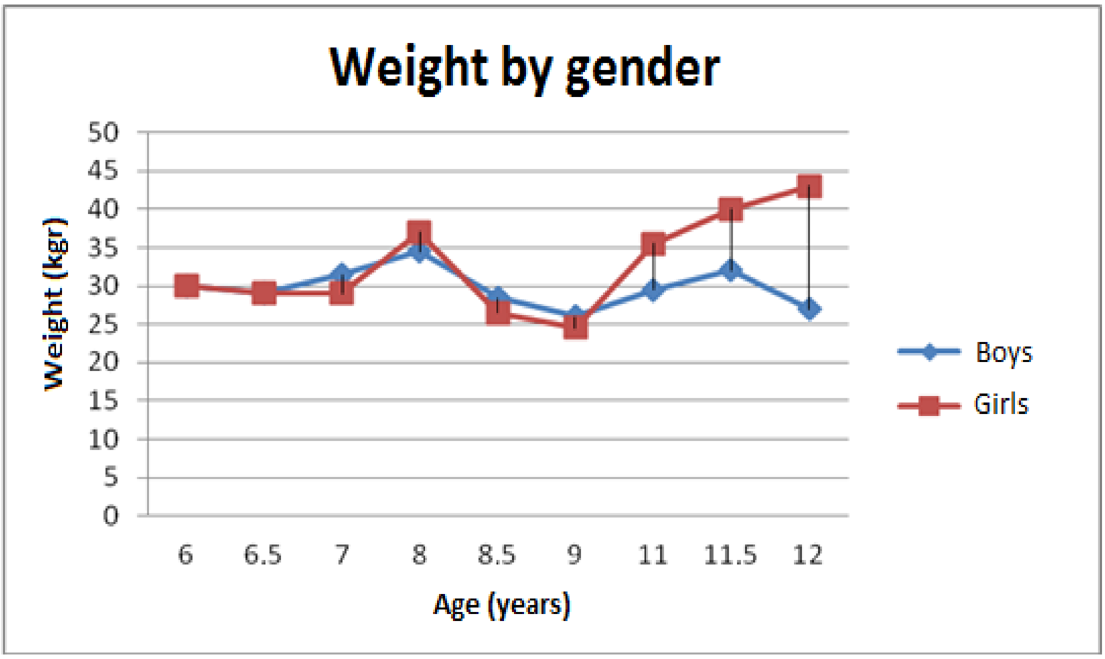
Figure 1. Comparative distribution of height by age and sex of the sample.



Self processed

There is an immerse in the age of 9 and a sudden increase thereafter, with the deviation reaching 20 cm. at 12 years for girls.

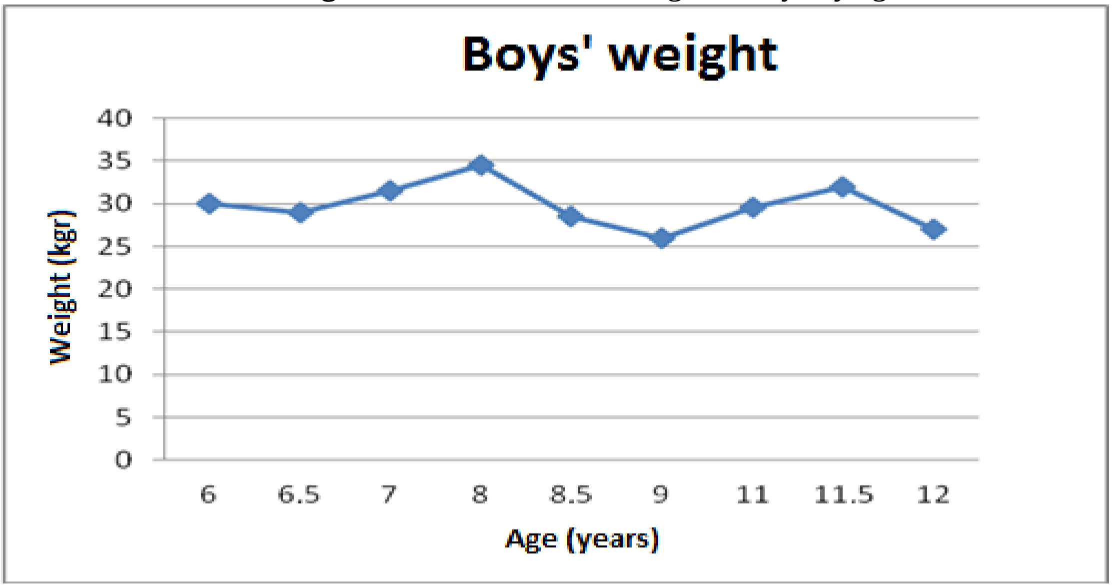
Figure 2. Comparative weight distribution by age and sex of the sample.



Self processed

The deviation is 16 kg for girls at the age of 12 years.

Figure 3. Distribution of weight in boys by age.



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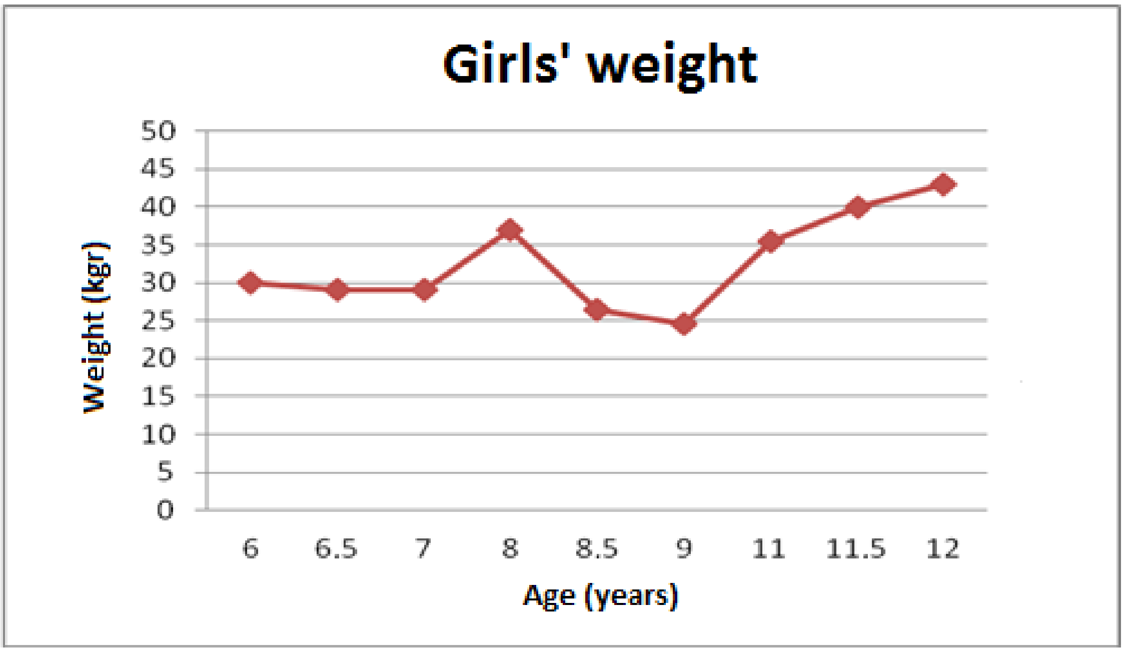
There are two peaks at the age of 8 and 11 years, with the median value being lower at 12 years compared to 6 years.

Figure 4. Distribution of weight in girls by age.



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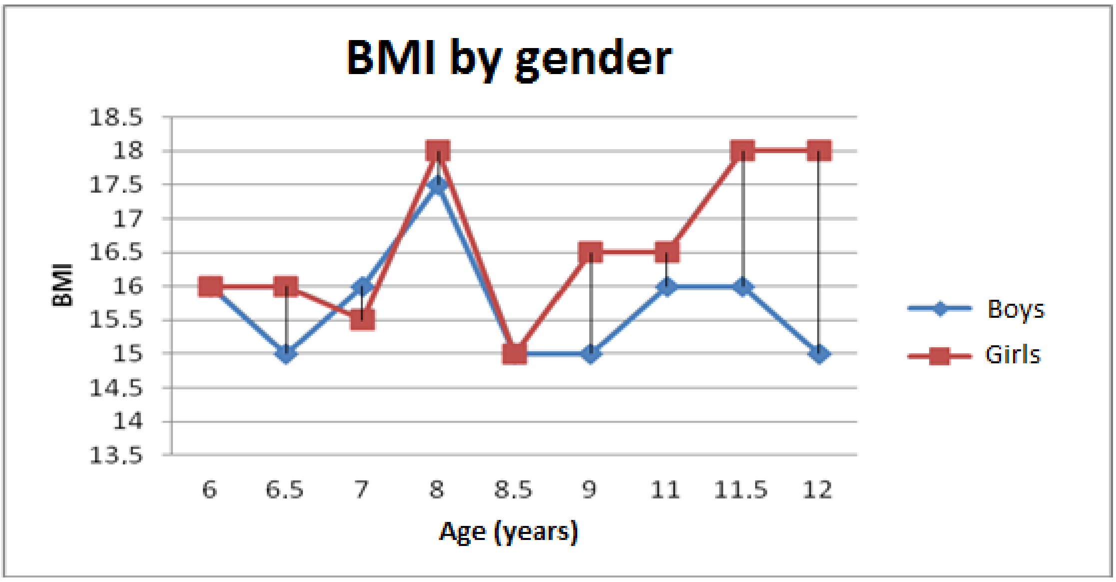
From the age of 9, and then the weight has increased steadily to reach 45 kilos at the age of 12 years.

Figure 5. The change in the median value of BMI in boys and girls by age.



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The projection of the median values of BMI for both sexes on the growth curves currently used in our country and suggested by WHO, allows us to conclude that there are significant declinations and possibly the practice of any existing growth curves leads to a significant underestimation of obesity in our country. None boy and girl at any age found overweight according to the health ministry growth curves, while in the age of 8 years, the median value, both for boys and girls moved into the 'overweight' zone in the WHO curves (Z-SCORES ≥1), as shown in the charts.

Table 10. Percentage of normal weight students, overweight and obese by sex of the sample according to the percentiles of the IOTF.

	NORMAL WEIGHT		OVERWEIGHT		OBESE	
	N	%	N	%	N	%
BOYS	95/121	78,6	17/121	14	9/121	7,4
GIRLS	92/118	78	18/118	15,2	8/118	6,8
TOTAL	187/239	78,3	35/239	14,6	17/239	7,1

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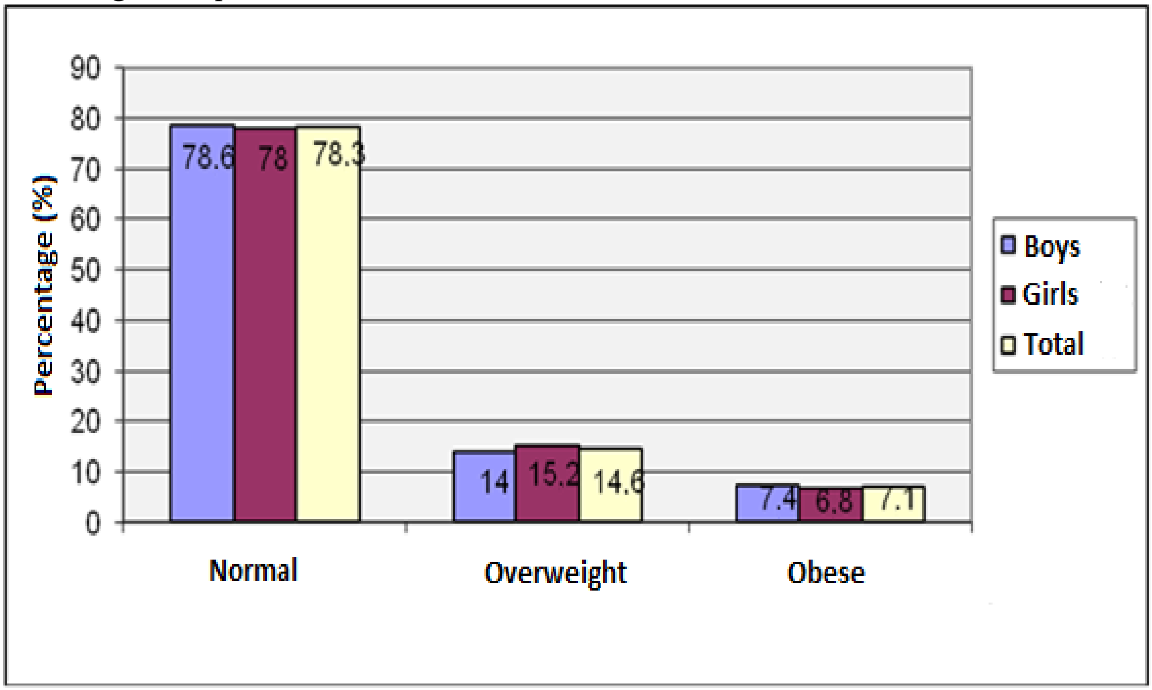
Figure 6. Percentage of normal weight students, overweight and obese by sex of the sample according to the percentiles of the IOTF.



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5. Discussion

In this study a simple record of the findings in cross sectional basis at specific age groups was done and it was not considered any causative factors nor prospectively determined the development of children. Therefore, it is not possible to draw conclusions on possible causes, which are responsible for these differences, but also to increase the prevalence of overweight and obese children in Greece. The results of this study are consistent with the results of other investigations carried out in children of the same age internationally and in Greece, and which indicate a significant upward trend in the prevalence of overweight and obese children over the years, with the possible exception of the study of Karayiannis et al (2003), the results of which showed a very low prevalence of obesity (less than 3%). However, this study was based on data from self-reported height and weight values.

In the present study the internationally recommended limits are used, which resulted from the study of large series of children from different countries, based on the extension of adult curves for BMI and values 25th and 30th. The percentages of overweight children in this study are equivalent to those observed in Western countries over the last fifteen years. However, obesity rates are among the highest worldwide and specific to those observed in low-income areas. Thus, in low-income urban areas in Montreal, Canada, found a percentage overweight 35.9% and obesity 15.9% in 1993, which annually increased by about 1% (O'Loughin et al 2000).

In Greece, according to 2001 data, the percentage of overweight boys aged 6-17 years reaches 25% versus 19% of girls while obesity rates averaging 5% for boys and 3% for girls between the same ages, with the percentages being higher in younger ages (Krassas 2001). The distribution varies between different studies, depending on the criteria used in obesity. However, they present an increasing trend over time (Kyritsi 2004). A rising trend in obesity rates has been reported in the wider Greek area. 20.3% of boys and 18.1% of girls aged 11-12 years in Cyprus found to be overweight based on the 85th percentile for body mass index (BMI) in modern growth curves from the US (the limits which was 6-7 % higher than in the past) (Kouridis 2000).

In the study of Kyriacou (2009), statistically significant differences were observed in rates of overweight children between urban and rural areas, where the prevalence of overweight is higher in urban areas, which is confirmed by other studies worldwide (Oner at al 2004, Malik & Bakir 2006), but also in Greece (Manios et al 2005, Karayannis et al 2003).

6. Conclusions

This study highlights the problem of obesity in the Greek region and confirms the reservations about the applicability of the proposed development curves by the Ministry of Health during the five years 2001-2006. The Greece is among the countries with the highest childhood obesity rates in the world, and generally in the Mediterranean countries the percentage of overweight and obese children is 10-15% higher than the corresponding rates in the North European countries (Dehghan M et al, 2005).

In this study, the percentage of overweight boys were **14%** and **7.4%** obese, while the percentage of overweight girls was **15.2%** and obesity **6.8%** in the whole sample (according to the percentage of positions IOTF), which means that one in five boys and about one in four girls is above the normal weight for his age and height.

According to the curves used in the health certificates of children in our country, children of our sample show no obesity problem, nor in their extreme values. Note that new growth curves in our country have caused considerable debate about the classification of children as overweight or obese, as they tend to underestimate the problem, at least according to international standards.

The systematic quantitative evaluation of dietary habits and the systematic recording of physical activity in childhood and adolescence, in addition to evaluating the mental and physical well-being of children under long-term interventions will highlight the parameters which play a vital role in changing children's habits and will help to reduce the problem of childhood obesity in our country. Reduced levels of physical activity, as well as so-called post-war syndrome (children overfeed from overprotective mothers) seem to still haunt the Greek society and are responsible to a significant extent for the high rates of obesity in our country. Furthermore, to the increase of the problem has contributed the urban life, the lack of training areas, the reduction of sport hours in schools and the fact that at home kids stranded in front of the TV and computer games.

It is necessary a close monitoring of the obesity issue together with the construction of reliable growth curves with national data collection, as the problem of obesity has major social and economic consequences. Childhood obesity in Greece is a serious problem for the country's future, as these children will remain at 50-80% obese adults consistently increased incidence of cardiovascular diseases, diabetes and many other diseases that afflict obese adults.

As lifestyles and habits formed at an early age, intervention strategies should focus on adopting healthy lifestyles and nutrition in childhood. Interventions should include increasing physical activity, reducing TV viewing hours, adopting healthy eating habits at school and at home and informing of the parents.

In conclusion the data of the study show that the prevalence of childhood obesity, as defined by the criteria of the International Obesity Research Group (IOTF), is higher compared with other developed countries and concerns both sexes.

Large population studies that relate to a representative sample of children from all the country and all age groups, it is necessary to define the prevalence at national level and setting standards growth curves without controversy. The declaration of growth curves which will allow precise imprinting of the problem of obesity should be a primary concern of health services and will allow pediatricians better monitoring of children, and early intervention to face the problem. Likely to clarify the issue, the parallel reference use of the growth curves of WHO constitutes a realistic approach to the problem of obesity in our country.

6.1 Limitations

In the limitations of the study should be noted the small sample, which limits the possibility of comparisons between different groups, and that the study involved all students irrespective of their origin or their residence from abroad. The small number of foreign students would not allow reliable statistical comparisons.

6.2 Suggestions

Future research should deal with the evaluation of the environmental factors which play an important role in the development of children in the mountainous regions of the country in order to give reliable answers that explain the observed differences in the prevalence of obesity among urban and mountainous / rural areas and variabilities of body characteristics by age. The state should encourage and support these initiatives financially, so there is a best possible depiction of the development of Greek children nationwide. In this way it will be possible to evaluate possible inhibitory factors of growth and to face, while to identify the factors which are responsible for the differentiation of development from an area to another and to study better the growth curves.

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Program Facing Childhood Obesity through Improvement of Nutrition and Enhancement of Physical Activity in Elementary School' s Students Aged 11-12 Years Old.

Abstract:

Childhood obesity is a serious public health problem worldwide. The school constitutes the ideal place to implement health promotion programs aimed at childhood obesity reduction. This study aimed to implement and evaluate the effectiveness of a health promotion intervention program to prevent and reduce obesity in adolescents aged 11-12 years, students of primary school.

The intervention program through the provision of knowledge about nutrition and physical activity issues had ultimate aim of reducing the rates of obese and overweight children by improving eating habits and the adoption or increase physical activity of children. As targets it had reducing the body mass index in the overweight and obese children, the increase of children's knowledge in nutrition, the improvement of their eating behavior, the adoption of positive views and behaviors about healthy eating and physical activity and the increase of children's participation in physical activities outside of the school curriculum in the intervention group.

The program was implemented in ten two-hour sessions with educational activities for healthy eating and physical activity for four months. 165 children who attended the E! and F! grade from two private schools participated in the program. 50 constituted the intervention group and 115 the control group.

At the beginning of the program, and when it was completed, measurements of body (weight, height) were made and information on the eating habits, knowledge and levels of physical activity of adolescents were collected. Gathering information on knowledge, dietary habits and physical activity was done with the questionnaire (CATCH Kids Club after school student questionnaire).

The results of the study showed that children's knowledge in the intervention group and their food choices were improved significantly after the intervention compared to_the control group. On the contrary, both groups showed no statistically significant difference in the rates of overweight / obese children, in the mean body mass index and in the percentages of the children who participated in a sport outside school before and after the intervention.

In conclusion, this health promotion program achieved some of its objectives. Failure to achieve all the objectives may be due to the short duration of the intervention and the lack of interventions in the family.

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1. Introduction

Aggregate data have shown that economic downturns might have few adverse effects on health. (Ruhm, 2008).

An explanation is that recessions improve health behaviors by providing increased leisure time that can be used for health improving activities (i.e. exercise), and cause people to reduce consumption of unhealthy foods (because they have less money). (Catalano, 2005).

Researches show that unemployment adversely affects health. Poor health in unemployed groups is a result of reduced financial resources, because loss of income can lead to poor nutrition. (Paul, 2009).

A financial crisis could lead to increases in healthy behaviors (eg. walking, cycling) and reductions in risky behaviors (eg. consumption of unhealthy foods). (Ahmad, 2008,)

2. Epidemiology

Obesity is considered to be epidemic worldwide. It's estimated that more than one billion adults are overweight and at least 300 million of them are obese. (WHO, 2003). Overall, 16.7% of the population worldwide has a problem with the extra weight (Ebbeling, 2002).

Obesity increases the risk of diabetes type II, cardiovascular diseases, psychological and social problems.

Moreover, increased body weight in childhood and adolescence is associated with increased body weight in adulthood (Serdula, 1993, Whitaker, 1997).

Childhood obesity constitutes a serious public health problem. It is estimated that 200 million school-age children are overweight, of which 40-50 million are obese,(IOTF). Greece is among the countries with the highest rates between European countries and worldwide (Chroussos, 2003; Tambalis, 2010).

3. Effects and Consequences

Risks of childhood obesity can be divided into two categories: psychological/social problems and health problems. The increase of sedentary lifestyle in combination with the intake of unhealthy foods and high-fat is one of the main factors leading to the increase of obesity, and it hides risks for type II diabetes, cardiovascular problems, high cholesterol, hypertension, and psychosocial disorders such as low self-esteem, which leads to depression (Zahner, 2006, Strauss, 2000).

4. Purpose

The purpose of this study was the implementation and evaluation of a health promotion program, an intervention that lasted four months in adolescents aged 11-12 years, students of primary school. The program included providing knowledge to children in nutrition and physical activity through educational activities.

The ultimate aim of the program was:

- Reduction of the percentage of overweight and obese students until the end of the intervention program.

The intermediate objectives were:

- Reduction of the body mass index in the overweight and obese children in the intervention group
- increase of children’s knowledge in nutrition
- improvement of their feeding behavior
- adoption of positive views and behaviors about healthy eating and physical activity
- increase of children’s participation in physical activities outside school.

5. Materials and Methods

The population was 165 boys and girls aged 10-11 years, students of the fifth and sixth grade of primary school who attended schools in Attica. The selected schools were the private schools**.**

Students and their parents were Greek (without Greek origin importing a criterion in the study). The population was detected in two groups, intervention group, consisting of 50 students, selected from the "Montessori schools" located in Varympompi, and a control group consisting of 115 students selected from the "ELLINOANGLIKI EDUCATION" located in Maroussi.

The reference population in which the results of this study can be generalized consists of boys and girls aged 11-12 years living in the wider region of Attica, have Greek origin and have similar socio-economic characteristics. The population involved in the intervention for four months, from February 1st, 2010 to May 31st, 2010.

Before the implementation of the program, the program was presented to the Director of each school and a written letter was also sent to the parents of the children involved, in order to learn about the importance, the content of the intervention and to give their written approval.

It was made clear to parents and participants that the personal data which will be recorded during the survey will be kept strictly confidential, and that they can leave the program at any time they want.

The collection of information was provided on a questionnaire. This information was about socio-demographic characteristics, knowledge on nutrition, diet and information about physical activity of students. These were assessed by the Greek translation of the questionnaire CATCH Kids Club after school student questionnaire.

The questionnaire recorded information for:

- socio-demographic characteristics such as gender, age, occupation, educational
- level and nationality of parents,
- students' knowledge on nutrition generally and health food in particular,
- their eating habits and
- the level of physical activity of the population under consideration.

Measurements of the height and weight of students were collected before the beginning of the program and when it was completed. The children were measured with light clothing and without shoes. The measurements were made during the first class period before the break, so that the only food that children had consumed was breakfast.

Weight measurement

A digital electronic scale was used. The weight measurement was made twice for every child. The measurement and recording differential of the weight was 100g.

Height measurement

A measuring rod with movable head was used. Each individual divided equal weight on both feet, remaining head horizontal. The hands were left free on the side with palms facing thighs. The heels, the buttocks, the shoulders and the back of the head were in the same vertical plane (parallel to the wall). The measurement and recording differential of the height was 0.1cm.

Equipment

The equipment that was used was:

- Scale: Seca digital scale (Seca Model 861, Hamburg, Germany).
- Height: Leicester Height Measure, Invicta Plastics Ltd, Oadby, UK.

Body mass index

The body mass index (BMI) was calculated and it was considered as a satisfactory obesity index that expresses the total mass of body fat by correlating weight with height. It is calculated by dividing weight in kilograms (Kg) by the square of height in meters (m).

Children were categorized according to the criteria of the International Obesity Task Force (IOTF) for childhood obesity in the following three categories:

- Normal: children with BMI above the curve corresponding to BMI = 20kg/m^2 at the age of 18 years old.
- Overweight: children with BMI above the curve corresponding to BMI = 25kg/m^2 at the age of 18 years old.
- Obese: children with BMI above the curve corresponding to BMI = 30 kg/m^2 at the age of 18 years old.

The program was implemented in ten weekly two-hour meetings which were held in school separately for each class and lasted four months.

Based on health education material which was entitled "Nutrition-Dietary habits" and "Physical Activity and Health" for students aged 9-12 years of the Ministry of Education in collaboration with the National Youth Foundation (Athens 2008 Editor John Manios).

6. Statistical Analysis

The mean values (mean) and standard deviations (Standard Deviation = SD) were used to describe quantitative variables. To compare quantitative variables between two groups the Student's t-test was used. To compare quantitative variables between more than two groups the parametric analysis of variance control (ANOVA) was used. To control the type I error, due to multiple comparisons, the Bonferroni correction was used, whereby the level of significance is 0.05/k (k = number of comparisons). To compare factors between measurements paired t-test was used. The analogous comparison was made with the criterion χ^2 or the Fisher's exact test where it was necessary.

The method of repeated measurements ANOVA was used to further assess differences in factors between the various groups. The level of significance is bilaterally and the statistical significance was set at 0.05. For the analysis SPSS 17.0 statistical program was used.

7. Results

The sample was consisted of 165 children (115 in the control group and 50 in the intervention group) with a mean age of 11.5 years (± 0,5).
The mean body mass index in the control group before the intervention was 19,1 ± 2,9, while in the intervention group was 20,4 ± 3,7 (p = 0,016).
In the control group the mean BMI was increased significantly (p-value: 0,002) after the intervention.

In the intervention group the mean BMI was decreased from 20,4 kg/m^2 to 19,9kg/m^2, but the difference was not statistically significant.

Table 1. Mean BMI separately for each group and compared between the two groups before and after intervention.

Group	Body mass index (kg / m2)			P**	P‡
	Before the intervention	After the intervention	Change		
	Mean ± SD	Mean ± SD	Mean ± SD		
Control	19,1±2,9	19,2±2,8	0,1±0,3	**0,002**	**0,031**
Intervention	20,4±3,7	19,9±3,8	-0,5±2,7	0,227	
P*	**0,016**	0,156			

* Difference between groups. ** Difference between measurements. ‡ Repeated measures ANOVA. Differences in the change from one measurement to the other between the groups.
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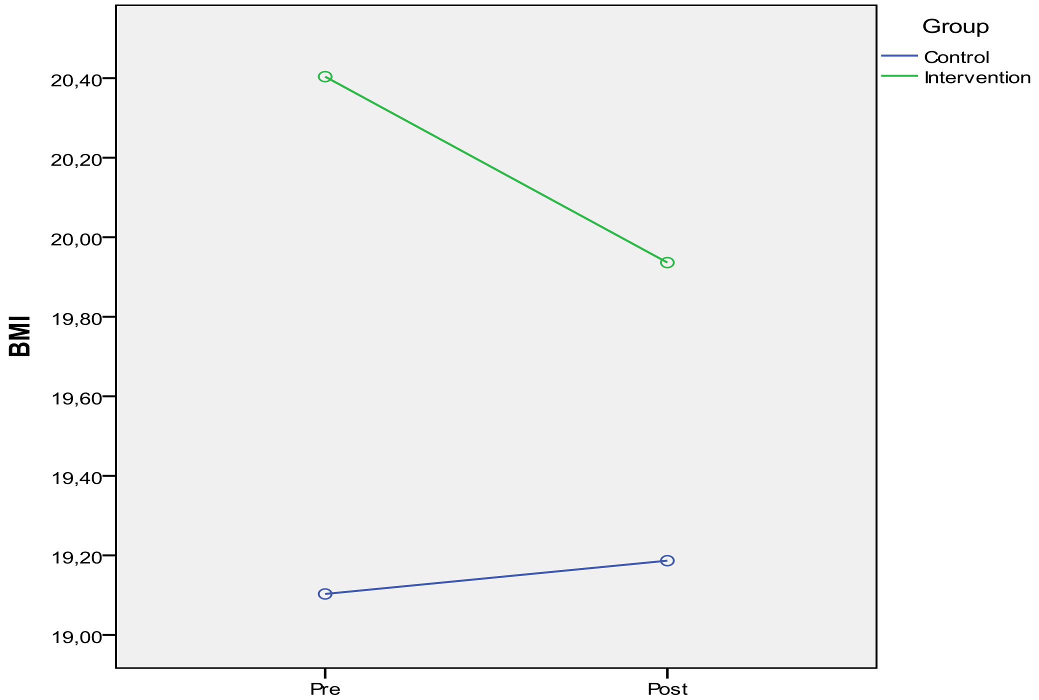
The rate of change of the children's BMI was significantly different between the 2 groups (p-value: 0,031). The BMI of the control group increased, while the BMI of the intervention group decreased.

Figure 1. Change in BMI before and after intervention in both groups.



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In Table 2 is observed that 72.2% of children have normal body weight in the control group and 48.0% in the intervention group before implementing the program. The percentage of overweight children in the control group is 23.5% and in the intervention group 50% before the implementation of the program.

The percentage of the overweight children was higher, significantly, in the intervention group before the intervention.

Table 2. Percentages of children with normal weight, overweight and obese * based on body mass index for each group before and after intervention.

Body mass index	Group			
	Control		Intervention	
	Before the intervention	After the intervention	Before the intervention	After the intervention
	N (%)	N (%)	N (%)	N (%)
Normal	83 **(72,2)**	85 (73,9)	24 **(48,0)**	26 (52,0)
Overweight	27 **(23,5)**	26 (22,6)	25 **(50,0)**	23 (46,0)
Obese	5 (4,3)	4 (3,5)	1 (2,0)	1 (2,0)

According to the curves of Cole (ref)
Self processed

Figure 2. Graph of the percentage of overweight / obese children separately for each group and each measurement**.**

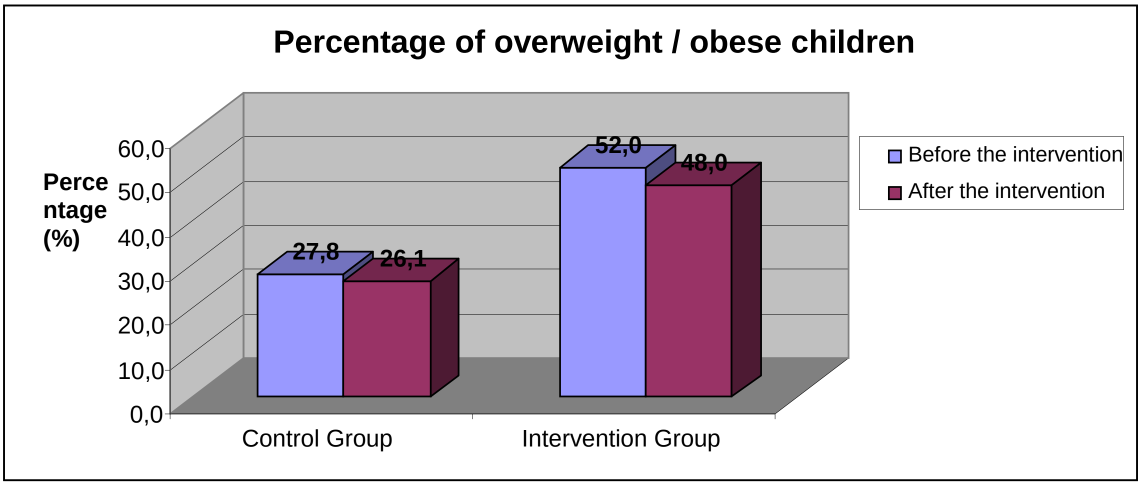

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Table 3 provides information on the general knowledge of children for diet separately for each group before and after intervention.

Before the intervention, the percentage of children in the control group that answered correctly that diet should include more bread, cereal, rice and pasta every day was statistically significantly greater than the corresponding percentage of children in the intervention group (30.4 % vs. 14 , 0%, p = 0,026).

After the intervention, the percentage of children in the control group that answered correctly that diet should include more of these foods each day was statistically significantly lower than the corresponding percentage of children in the intervention group (30.4 % versus 58,0%, p = 0.001) .

In the intervention group's children, there was a statistically significant increase in correct answers to this question after the intervention (14.0 % before versus 58.0 % , p <0,001).

Before the intervention, the percentage of children in the control group that knew that diet is associated with cardiovascular disease or cancer was statistically significantly greater than the corresponding percentage of children in the intervention group (72.2 % versus 44,0%, p = 0.001) .

After the intervention, at the children of the intervention group, there was a statistically significant increase in the percentage of correct answers to this question (44, 0 % versus 78,0%, p <0,001).

Table 3. General knowledge of children on diet separately for each group before and after the intervention.

		Group			
		Control		**Intervention**	
		Before the intervention	**After the intervention**	**Before the intervention**	**After the intervention**
		N (%)	**N (%)**	**N (%)**	**N (%)**
From which food group should you eat most every day?	*Bread, cereal, rice, pasta (correct answer)*	35 **(30,4)**	35 **(30,4)**	7 **(14,0)**	29 **(58)**
	Group of milk	12 (10,4)	15 (13,0)	6 (12,0)	3 (6,0)
	Fats, oil, sweets	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)
	Fruit	39 (33,9)	33 (28,7)	11 (22,0)	9 (18,0)
	Meat, fish, eggs, nuts	12 (10,4)	12 (10,4)	10 (20,0)	4 (8,0)
	Vegetables	15 (13,0)	15 (13,0)	4 (8,0)	3 (6,0)

	I do not know	2 (1,7)	5 (4,3)	12 (24,0)	2 (4,0)
Is the diet associated with cardiovascular disease or cancer?	*Yes (right answer)*	83 **(72,2)**	83 (72,2)	22 **(44,0)**	39 **(78,0)**
	No	6 (5,2)	6 (5,2)	2 (4,0)	0 (0,0)
	I do not know	26 (22,6)	26 (22,6)	26 (52,0)	11 (22,0)

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In Table 4 it is given the score of children knowledge on nutrition separately for each group and compared, before and after the intervention. This score was based on questions of general knowledge in Table 3 and it takes values on a scale from 0 to 4. Higher scale values indicate greater knowledge.

Before the intervention, the knowledge score was higher in the control group children significantly compared with the scores of the children in the intervention group (2, 4 versus 1, 4, p = <0,001). In the intervention group, there was a statistically significant increase in knowledge score after the intervention (1, 4 versus 2, 4, p <0,001).

Table 4. Grade of children knowledge on nutrition separately for each group and compared with each other before and after the intervention.

*

Group	**Knowledge on nutrition**			**P****	**P‡**
	Before the intervention	**After the intervention**	**Change**		
	Mean ± SD	**Mean ± SD**	**Mean± SD**		
Control	2,4±0,9	2,4±0,9	-0,01±0,1	0,319	**<0,001**
Intervention	1,4±0,9	2,4±1	1,0±1,0	**<0,001**	
P*	**<0,001**	0,975			

Difference between groups

** Difference between measurements.

‡ Repeated measures ANOVA. Change's differences from one measurement to the other between the groups.

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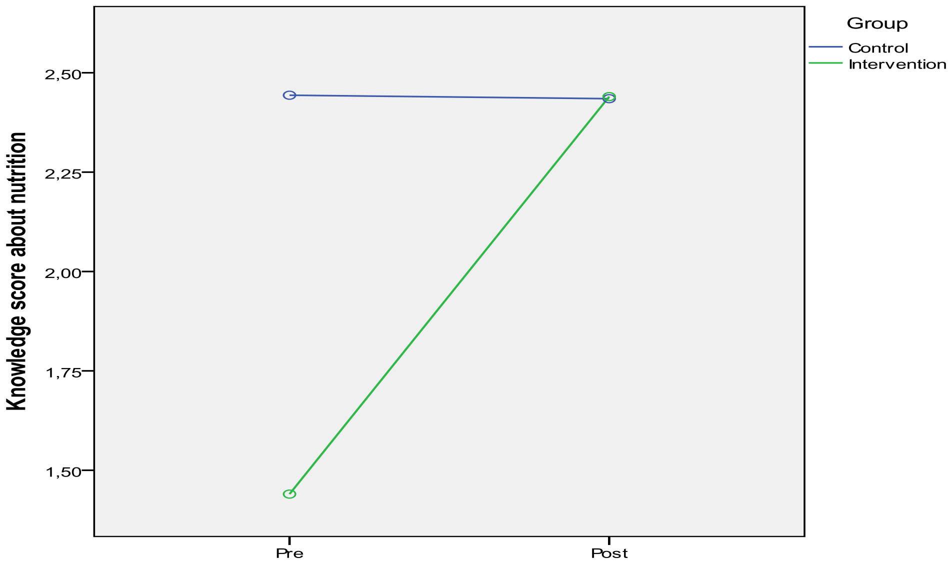
The grade of change in the ranking of the children knowledge was significantly different between the 2 groups. The knowledge score of the intervention group increased.

Figure 3. Change in score knowledge on nutrition before and after the intervention in both groups compared.



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In Table 5 it is given score of the proper nutrition of children separately for each group and compared with each other before and after the intervention.

The rating was based on the knowledge of children about healthy eating and information on children's choices regarding food with low fat and no added salt. The right diet score takes values on a scale from 0-21 and each right choice was marked with 1 and each wrong choice was marked with 0.

Higher values indicate better nutrition.

Table 5. Grade of proper nutrition based on knowledge of children about healthy eating and information on food choices low fat and no added salt, separately for each group and compared with each other before and after the intervention.

Group	Rating proper nutrition			P**	P‡
	Before the intervention	**After the intervention**	**Change**		
	Mean ± SD	**Mean ± SD**	**Mean ± SD**		
Control	16,1±3,5	16±3,4	-0,1±0,5	0,072	**<0,001**
Intervention	14,3±4,4	16,6±4,2	2,3±5,0	**0,002**	
P*	**0,013**	0,373			

* Difference between groups
** Difference between measurements.
‡ Repeated measures ANOVA. Change's differences from one measurement to the other between the groups.
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The proper nutrition score was significantly higher in children in the control group before the intervention compared with the scores of the children in the intervention group (p =

0,013). The rating of the children in the intervention group increased significantly after the intervention (p = 0,002).

The degree of change in the score proper nutrition was significantly different between the 2 groups. The rating right diet of control group was decreased while the right diet score in the intervention group was increased.

Figure 4. Change in rating proper nutrition before and after the intervention in both compared groups (from Table 5).

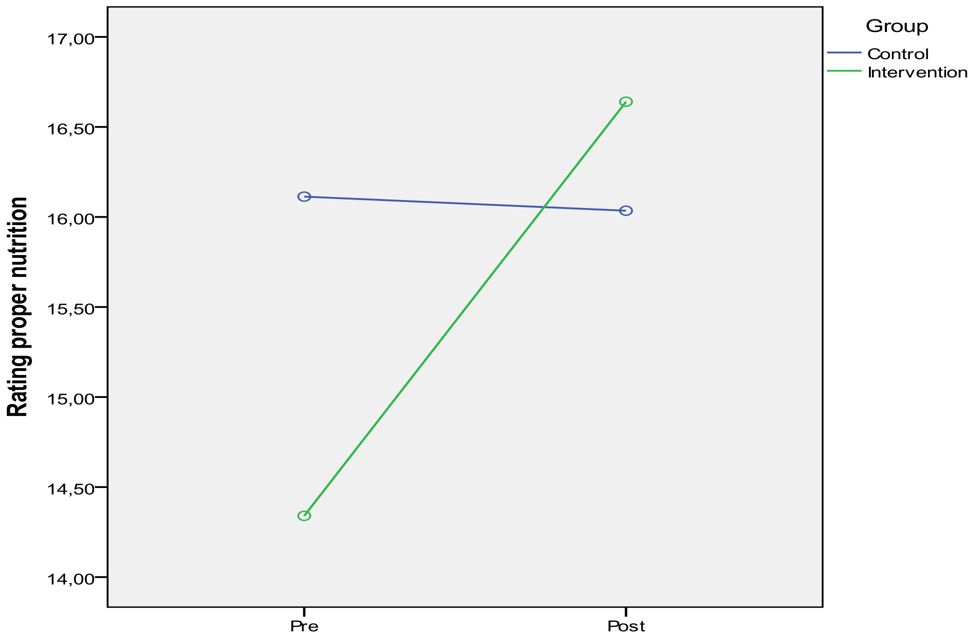

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Table 6. Information about children's occupation with television and /or video games separately for each group, before and after the intervention.

		Group			
		Control		Intervention	
		Before the intervention	**After the intervention**	**Before the intervention**	**After the intervention**
		N (%)	**N (%)**	**N (%)**	**N (%)**
How many TV shows do you watch during the week?	I do not watch TV at all	**8 (7,0)**	8 (7,0)	**1 (2,0)**	1 (2,0)
	1	18 (15,7)	18 (15,7)	8 (16,0)	6 (12,0)
	2	51 (44,3)	50 (43,5)	20 (40,0)	26 (52,0)
	3 or more	38 (33,0)	39 (33,9)	**21 (42,0)**	**17 (34,0)**
During the week how many hours a day do you play video games or	I do not play video games and do not use the computer	30 (26,1)	30 (26,1)	9 (18,0)	15 (30,0)
	Less than 1 hour a day	50 (43,5)	50 (43,5)	22 (44,0)	22 (44,0)
	1-2 hours a day	30 (26,1)	30 (26,1)	12 (24,0)	11 (22,0)
	More than 3 hours a day	5 (4,3)	5 (4,3)	**7 (14,0)**	**2 (4,0)**

use the computer?					

Self processed

Before the intervention in the intervention group, 42 % of children used to see more than three shows during the week. After the intervention, the percentage drops to 34 % but the results are not statistically significant.

Before the intervention the percentage of children in the intervention group that used to play video games or use the computer more than 3 hours a day during the week was 14.0 % and it decreases to 4 % after the intervention, but the finding is not statistically significant.

Table 7. Participation of children in physical activities outside school, separately for each group before and after the intervention.

		Group			
		Control		**Intervention**	
		Before the intervention	**After the intervention**	**Before the intervention**	**After the intervention**
		N (%)	**N (%)**	**N (%)**	**N (%)**
Besides gymnastics of school, do you participate in some physical activity outside school?	Yes	**98 (85,2)**	98 (85,2)	**41 (82,0)**	42 (84,0)
	No	17 (14,8)	17 (14,8)	9 (18,0)	8 (16,0)
If yes, how many times a week?	None	17 (14,8)	17 (14,8)	9 (18,0)	8 (16,0)
	1 time	1 (0,9)	1 (0,9)	5 (10,0)	4 (8,0)
	2 times	30 (26,1)	30 (26,1)	13 (26,0)	11 (22,0)
	3 or more	**67 (58,3)**	**67 (58,3)**	**23 (46,0)**	**27 (54,0)**

Self processed

Before the intervention, 82 % of the children in the intervention group and 85.2 % in the control group used to participate in physical activities outside school. Before the intervention, 58.3 % of the children in the control group and 46% of the children in the intervention group used to participate in physical activities more than 3 times a week. After the intervention, the percentage of the children in the intervention group that participates in physical activities more than 3 times a week was increased to 54% (not statistically significant difference), while the percentage in the control group remained the same.

Following the implementation of the intervention it was found that the two compared groups showed differences in their knowledge and their eating habits (choices).

Knowledge of children in the intervention group and their eating habits were improved significantly after the intervention compared with the control group.

The fact that the intervention helped to increase the nutritional knowledge of children in the intervention group, - one of the objectives of the program - is evaluated as one of its successes. Similar interventions with shorter duration, led to an increase in knowledge. (King et al., 1988)

A striking example is the question that helped children learn that they should eat more foods from the group of cereals daily. There was an increase in the percentage of correct answers to this question in the children in the intervention group after the intervention (14.0% vs. 58, 0%, p <0,001).

The percentage of the children that answered correctly that diet is associated with cardiovascular diseases or cancer in the intervention group was increased significantly after the intervention (44.0 % before versus 78.0 % then, p <0,001).

Trying assess children's knowledge on proper nutrition with a scale receiving values from 0-21(giving a value of 0 at the wrong choice and 1 at the right), proved that there was a statistically significant increase in knowledge score after intervention in children of the intervention group (Table 4).

The proper nutrition score of children in the intervention group was increased significantly after the intervention (Table 5).

After the intervention, the mean BMI was decreased but not significantly. Our finding is consistent with studies showing that after the end of the interventions are marked beneficial and significant changes in BMI (Kain et al., 2004, Rachael et al., 2007).

In this study we created a nutrition knowledge index to integrate individual features of the daily diet (4 features). It was found that children's knowledge score of the intervention group was increased significantly after the intervention (Table 4).

8. Benefits

The program didn't create problems in the school's courses. There wasn't a high cost as it was implemented exclusively by the researcher, and the most means of teaching were school's materials, as projector, board etc.

The material used was adapted to the specific ages and it was perfectly understandable.

The program was evaluated by teachers and students. The evaluations showed that the children were satisfied, they understood easily and participated a lot. Also, children with identified learning disabilities showed interest in the program and participated to the surprise of their teachers. Teachers described the program valuable and the handbook quite creative.

This intervention is a pilot application, confirming that the school environment gives the ability to implement effective programs aimed at promoting a healthy lifestyle through increased knowledge of nutrition and physical activity.

9. Limitations

The number of the participants was small. Therefore, the population of the study can't be considered representative of the general population of Greek students 11-12 years living in Attica. For this reason, the descriptive findings concerning the percentages or the mean values of various parameters can't be considered as representative of the general population.

Also, another drawback is that the separation of children in the intervention group and control group was not randomized and is likely to have affected the comparisons made between the two groups.

The period that the intervention lasted is considered inadequate, as the literature suggests that it is required longer duration of time from a few up to 15 weeks in order a health education program to be effective (Woolfe, 2005).

Another stumbling factor was the fact that the program imposed on children without children have the opportunity to choose whether they want this issue on nutrition and physical activity or another.

So it is absolutely necessary to make an assay of the team before the intervention, in order to determine whether the group is interested in this program and if there is a need of the implementation of this program. Besides, it is known, that the knowledge of all these parameters creates the conditions for developing the relationship of trust between the health education instructor and trainees.

In this study detection of the group's needs couldn't made due to lack of time. Another issue is the fact that health education programs should include family's participation in activities related to preparing healthy food (Risvas et al., 2008). If the family is absent, then the effectiveness of such interventions is severely limited. In all the programs that have been successful, the participation and the influence of the family are evident. (Arbeit et al., 1992).

The implementation of the intervention was made only by the instructor of health education as health visitor without the involvement of other specialties. As it is reported in the literature, effective interventions are implemented with the involvement by all scientists, such as doctors, nutritionists, psychologists, teachers, peers after training (peer education). (Cole et al., 2006).

10. Suggestions

It is absolutely necessary to have an institution under the authority of which the health education programs will take place and who will be responsible for implementation, coordination and evaluation**.**

It is of great importance programs be addressed to all schools regardless of demographic, social and economic characteristics of students.

Equally important is, programs to have duration in order to achieve changes in attitudes and behaviors. Commemorative visits should be made in schools where the programs have been made (follow up programs) in order to determine whether there have been changes in attitudes and behaviors and which ones are those that were maintained over time. It also requires assessment of the results and evaluation of programs.

Equally significant is the contribution of parents who should be informed with lectures by experts or training sessions and should be encouraged to participate in activities with their children.

Another suggestion would be health education programs to be addressed at Community level. (Basset et al., 2004).

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Using Graphic Calculator in Mathematical Teaching: Perceptions of Secondary Education Teachers

Abstract:
Technology-based tools have been found to be essential in teaching mathematics in high school, since they lead towards a better depiction, clarification and understanding of the difficult and complex mathematical concepts, and increase students' interaction and collaboration. Within this framework, graphics calculators have been found to have major benefits for students in understanding mathematics, motivating students, and making the lesson more interesting. This research examines the opinions of 83 mathematical teachers from 40 high school units in the region of Thessaloniki, with regard to the use of graphics calculators in teaching mathematics in high school. The results of the study indicated that teachers use graphics calculators as a reward for students and in the individual instruction for better students, but not for collaborative learning. Moreover, it was found that graphics calculators can motivate students, save time from making complex mathematical operations, and help students to gain an in depth understanding of mathematical concepts. In addition, however, it was found that the use of graphics calculator cannot promote higher thinking and meaningful understanding, and students may not be able to master mathematical manipulations on their own. Further research to more schools in Greece is needed.

Keywords: Technology, graphics calculators, mathematics, Thessaloniki

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1. Introduction

1985 was the year when graphic calculators were first appeared. Since then, many countries around the world included the use of graphic calculators in mathematical teaching (Tan &Forgatz, 2006). Their basic advantage is that they can provide students with multiple representations of mathematical concepts. Hence, as it has been indicated by several researchers, graphic calculators can provide students the ability to acquire an easy and in-depth understanding of some abstract mathematical concepts, such as functions, unequal scales and fractions, while at the same time it can help students in solving complex and difficult algebra problems (Smith, 1998; Robova, 2002; Ali et al., 2002; Cavanagh&Mitchelmore, 2003; Horton et al., 2004; Kastberg&Leatham, 2005; Jones, 2005; Ye, 2009; Tajudin et al., 2011).

As the use of graphic calculators in mathematics curricula is constantly expanding, it is of great interest to examine its impact on students' learning. For this reason, several studies have examined the perception of teachers. The interest in teachers' perception derived from the fact that their perceptions shape their positive or negative attitude towards the use of graphic calculators; thus teachers are important determinant factor in the use of graphic calculators in mathematical teaching (Cavanagh&Mitchelmore, 2003; Tan &Forgatz, 2006;Taiwo, 2009;Bennison&Goos, 2010). Moreover, the research in examining teachers' understanding about graphic calculators and their advantages in mathematical teaching is scarce.

The aim of this research is to examine teachers' perceptions in secondary schools in Greece, regarding their level of understanding of the advantages and disadvantages of graphic calculators in mathematical teaching, their knowledge about the use of these calculators, and the extent to which they have incorporate them in mathematical teaching. The outcomes of this research can be useful in findings ways to enhance the use of graphic calculators for mathematical teaching in secondary schools, through possible changes in teachers' perceptions.

2. Literature Review

Technology (ICTs) is a very attractive and interactive tool that can adapt the teaching practices to the learning style, interests and readiness of students. Teachers can be equipped with a variety of means regarding contents, activities and learning processes and different ways to monitor the achievement of the targets that have been set. ICTs in mathematics present information in many ways: visual, auditory, graphical, textual etc. suggesting many different routes for students to understand the content of the lesson, to edit mathematical concepts and to create activities (Smith &Thone, 2007). Moreover, ICTs play a significant role in the creation and development of collaborative learning, which is an educational approach for teaching and learning, where students cooperate together in order to perform an activity (Takaci et al., 2015).

Overall, the use of ICTs in education, and especially in mathematics, can result in the better depiction, clarification and understanding of the mathematical concepts that are taught (Beauchamp, 2011), in the active participation of students in the learning process (Orlando, 2013), and in the increase of the interaction and collaboration of students (Beauchamp, 2011; Orlando, 2013).

An important technology-based tool is also the graphic calculator. The use of graphic calculators in mathematics teaching has been found to result in increased student achievement (Dimock&Sherron, 2005; Jones, 2005; Mesa, 2008; Tajuddin et al., 2009), especially due to the fact that it can increase students' interest in the lesson (Tan et al., 2011). Graphic calculators can offer students higher order thinking, while students can perceive better and acquire and in depth understanding of the mathematical concepts, and their application in problem-solving, through representation (Kamarulhaili&Sim, 2005; Jones, 2005; Ocak, 2008; Tan et al., 2011; Tan et al., 2013). In addition, the use of this technological tool has been found to offer students a possibility of interacting with other classmates, as well as with the teacher (Tan et al., 2011; Tan et al., 2013). Other advantages of graphic calculator is that they allow the execution of difficult and complex operations and problems in less time, and with much funnier and in easier way (Kamarulhaili&Sim, 2005; Jones, 2005; Ocak, 2008; Tan et al., 2011; Tan et al., 2013). Overall, it is supported that graphics calculators facilitate the process of making connections between the mathematical concepts and the graphic representations, allowing the better understanding of mathematics and resulting in higher levels of students' achievements.

However, the use of graphic calculators has some major drawbacks, as well. To be more precise, Ocak (2008) argues that their use results in the automatic process of solving mathematical concepts, which does not allow students to explore a mathematical concept on their own; on the contrary, it pushes them to be based only on the calculators, instead of cultivating their abstract thinking. Similarly, some teachers expresses the opinion that the use of graphics calculator is a threat to students' skill development, since the automatic process of graphic representation of mathematical concepts does not allow students to fully understand the mathematical concepts. Thus, students rely even more to graphics calculators, instead of understanding and implementing on their own the mathematical operations, and representations (Margaritis, 2003). Last but not least, even though the use of graphic calculators may enhance the collaborative learning and the team work in the classroom, Ocak (2008) claims that their use may leads to the opposite result, where students show lack of willingness to participate in join group discussions.

3. Aim and Research Questions

The aim of this research is to explore teachers' perceptions regarding the use of graphics calculators in teaching mathematics in high school. The objectives of this research are the following: a) to explore teachers' perceptions about using technology in general in teaching mathematics; b) to examine the frequency and the purpose of using graphics calculators in teaching mathematics; c) to explore teachers' perceptions about using graphics calculators in teaching mathematics; d) to identify the advantages and disadvantages of using graphics calculators in teaching mathematics. Based on the above, the research questions of this research are the following:

1. What is the frequency of using graphics calculator in high school?
2. For which purposes are graphics calculator used in high school?
3. What are the advantages of using graphics calculator in teaching mathematics in high school?
4. What are the disadvantages of using graphics calculator in teaching mathematics in high school?

4. Method Research

Quantitative research was used for the purposes of this research. Quantitative research was used, since this type of research allows the statistical analysis of the opinions of the subjects of the research and the quantification of the opinions expressed (Muijs, 2010). Moreover, quantitative research has also the advantage of objectivity, which is another reason for which it was chosen over qualitative research (Hoy, 2010).

4.1 Methodological instrument

The methodological instrument used in this research is the structured questionnaire, because it is the most common and well-known tool for measuring respondents' opinion, whereas it can also be distributed to a large number of participants at the same time (Harris and Brown, 2010).The questionnaire (Appendix) was designed by the research for the purposes of this research, based on the questions that were used in previous studies (Dimock&Sherron, 2005; Tan &Forgatz, 2006; Bennison&Goos, 2010; Mason, 2010; Tan et al., 2011; Tan et al., 2013).

4.2 Participants

The sample of the research consists of 83 mathematic teachers from 40 high school units in the region of Thessaloniki. The majority of the participants in the research is females (59%), aged between 31-40 years old (33.7%), having 15-20 years of experience. The following table summarises the demographic profile of the teachers who took part in the research.

Table 1. Demographic profile of teachers

	Frequency	Percent	ValidPercent	CumulativePercent
Gender				
Male	34	41,0	41,0	41,0
Female	49	59,0	59,0	100,0
Total	83	100,0	100,0	
Age				
Upto 30 yearsold	24	28,9	28,9	28,9
31-40	28	33,7	33,7	62,7
41-50	14	16,9	16,9	79,5
Over 50 yearsold	17	20,5	20,5	100,0
Total	83	100,0	100,0	
Years of experience				
0-5	20	24,1	24,1	24,1
6-10	10	12,0	12,0	36,1
11-15	10	12,0	12,0	48,2
15-20	23	27,7	27,7	75,9
Over 20 years	20	24,1	24,1	100,0
Total	83	100,0	100,0	

4.3 Research procedure

The ethical issues that are raised are associated with the anonymity of the participants, the confidentiality of data, and the protection of the participants (Miller et al., 2012). The researcher has ensured the participants that their anonymity will be kept and that their opinions expressed will be used only for the purposes of this research. In addition, all participants were informed about the aim of the research, and that they would take part in the survey only if they agreed. Finally, it should be mentioned that there was no conflict of interest on behalf of the researcher, and that the researcher tried to be objective, conducting the research without any biases. For the statistical analysis SPSS 21.0 was used. The statistical methods used are descriptive statistics (Argurous, 2011). The research was conducted the time period 01.03.2016-30.03.2016.

5. Results

5.1 Use of technology in teaching mathematics

21.7% of the teachers who took part in the research claimed that they are enough confident in using technologies in teaching mathematics. Perhaps this stems from the fact that they majority (53%) have attended professional development seminars regarding technology use in teaching mathematics.

The following table presents the perceptions of teachers with regard to the use of technology in teaching mathematics. Their opinions indicate that technology is enough helpful to students in understanding concepts (M=3.41, S.D.=0.788), in improving student attitudes towards mathematics (M=3.40, S.D.=1.739), in making sophisticated concepts accessible to students (M=3.45, S.D.=1.856) and in helping students explore unfamiliar problems (M=3.72, S.D.=1.633).

Table 2. Perceptions of teachers regarding technology use in mathematics

	N	Mean	Std. Deviation
Technology helps students to understand concepts	83	3,41	1,788
Technology makes sophisticated concepts accessible to students	83	3,45	1,856
Technology helps students explore unfamiliar problems	83	3,72	1,633
Technology improves student attitudes towards mathematics	83	3,40	1,739

The following table presents the mean of the frequencies of technology use in various teaching modes. Teachers tend to use technology between one and three months as a reward for students (M=3.71, S.D.=1.771), but they to use it less often for collaborative learning, in terms of students' work in small groups (M=3.25, S.D.=1.759), and as a research tool (M=3.30, S.D.=1.716). What is interesting is that teachers prefer to use technology in the individual instruction for better students (M=3.63, S.D.=1.665), instead of using it for weaker students (M=3.48, S.D.=1.595).

Table 3. Frequency of use of technology in various teaching modes

	N	Mean	Std. Deviation
Teacherdemonstrations/lectures	83	3,54	1,748
Students work in small groups	83	3,25	1,759
Studentsworkindividually	83	3,40	1,703
Cooperativelearning	83	3,37	1,859
As a reward for students	83	3,71	1,771
Individual instruction for weaker students	83	3,48	1,595
Individual instruction for better students	83	3,63	1,665
Students use graphics calculators to check their working and answers	83	3,42	1,761
Students use graphics calculators to do more challenging questions	83	3,60	1,780
Students use graphics calculators as a research tool	83	3,30	1,716

5.2 Use of graphic calculators in teaching mathematics

Most of the teachers rate their current level of graphics calculator skills as advanced (37.3%). Perhaps this is due to the fact that they have attended professional development seminars regarding graphing calculators use in teaching mathematics (54.2%). The fact that teachers rate as advanced their skills in using graphics calculators may be the reason for which a large percentage (62.7%) claimed that the students use graphing calculators in their classes. Moreover, teachers answered that they use graphics calculators for about 4-5 years (43.4%), on a monthly basis (38.6%). With regard to how graphics calculators are made available to the students in their classes, the teachers answered that students are required to provide their own calculators (50.6%). In some cases the school provides each student with his/her own calculator (49.4%) and in even less cases, the school provides teachers with a classroom set of calculators (41%).

With regard to the ways in which students make use of graphics calculators, as depicted in the following table, teachers claimed that students use them mostly for Classroom Tests (57.8%), for Class Work (53%) for Homework (51.8%) and less for State Assessment Tests (44.6%). Regarding the purposes for which students use graphics calculators, as stated in the table below, teachers answered that they use them for Conceptual Understanding (53%), for Problem Solving (50.6%), for Operations (45.8%) and less for Practice (41%).

Table 4. Ways and purposes of using graphics calculators

	Frequency	Percent	ValidPercent	CumulativePercent
Ways in which students use graphics calculators				
Homework				
Yes	43	51,8	51,8	51,8
No	40	48,2	48,2	100,0
Total	83	100,0	100,0	
ClassroomTests				
Yes	48	57,8	57,8	57,8
No	35	42,2	42,2	100,0
Total	83	100,0	100,0	
ClassWork				
Yes	44	53,0	53,0	53,0
No	39	47,0	47,0	100,0
Total	83	100,0	100,0	
StateAssessmentTests				
Yes	37	44,6	44,6	44,6
No	46	55,4	55,4	100,0
Total	83	100,0	100,0	
Purposes for which students use graphics calculators				
Operations				
Yes	38	45,8	45,8	45,8
No	45	54,2	54,2	100,0
Total	83	100,0	100,0	
ProblemSolving				
Yes	42	50,6	50,6	50,6
No	41	49,4	49,4	100,0
Total	83	100,0	100,0	
Practice				
Yes	34	41,0	41,0	41,0
No	49	59,0	59,0	100,0
Total	83	100,0	100,0	
ConceptualUnderstanding				
Yes	44	53,0	53,0	53,0
No	39	47,0	47,0	100,0
Total	83	100,0	100,0	

The following table presents teachers' opinions regarding the graphic calculators use in specific teaching modes. As it can be seen, graphics calculators are used more in students work in small groups (55.4%), in teacher demonstrations/lectures (53%), in individual instruction for better students (51.8%), to do more challenging questions (51.8%) ad as a reward for students (50.6%). However, they are not used in cooperative learning (53%) and in individual instruction for weaker students (51.8%), as indicated above as well.

Table 5. Graphic calculators use in various teaching modes

	Yes (%)	No (%)
Teacherdemonstrations/lectures	53.0	47.0
Students work in small groups	55.4	44.6
Studentsworkindividually	43.4	56.6
Cooperativelearning	47.0	53.0
As a reward for students	50.6	49.4
Individual instruction for weaker students	48.2	51.8
Individual instruction for better students	51.8	48.2
Students use graphics calculators to check their working and answers	49.4	50.6
Students use graphics calculators to do more challenging questions	51.8	48.2
Students use graphics calculators as a research tool	49.4	50.6

5.3 Advantages and disadvantages of using graphic calculators in mathematical teaching

In general, teachers believe to a great extent that using graphic calculators for learning maths helps students to gain an in depth mathematical concept (22.9%) and understand maths better (19.3%), while it makes the lesson having more fun (20.5%). However, they think that students only to a moderate way enjoy the lesson using graphic calculators (21.7%). The following table presents teachers' opinions regarding the advantages of using graphic calculators in mathematical teaching. The greater advantages of using graphic calculators in teaching mathematics are that they motivate students (M=3.75, S.D.=1.786), they help students to save time from demanding calculations and sketching (M=3.72, S.D.=1.769), and that graphing calculator provides accurate answers (M=3.71, S.D.=1.715). To a smaller extent, teachers think that through the use of graphic calculators in teaching mathematics the students get to interact with both the teacher and their classmates in the lecture/tutorial room when I use the graphing calculator (M=3.24, S.D.=1.743).

Table 6. Advantages of using graphic calculators in teaching mathematics

	N	Mean	Std. Deviation
The graphing calculator provides graphical representations	83	3,30	1,813
The graphing calculator helps students to save time from demanding calculations and sketching	83	3,72	1,769
The graphing calculator allows students to explore mathematical properties	83	3,39	1,637
The graphing calculator motivates students	83	3,75	1,786
The graphing calculator aids investigations and explorations by students	83	3,25	1,745
The graphing calculator provides accurate answers	83	3,71	1,715
The graphing calculator illustrates graphs more clearly	83	3,31	1,674
The graphing calculator helps students in their discussions in the lecture/tutorial room	83	3,40	1,577
The graphing calculator stimulates and inspires students to realize their potential and learn important mathematical ideas and skills without feeling frustrated or miserable	83	3,59	1,781
The graphing calculator fosters learning and thinking by providing immediate feedback	83	3,43	1,647
The students get to interact with both the teacher and their classmates in the lecture/tutorial room when I use the graphing calculator	83	3,24	1,743
The students can read and interpret values better with a graphing calculator	83	3,64	1,736
The students understand the lessons better when using graphing calculator compared to merely using the textbook	83	3,54	1,748

However, the use of graphics calculators in teaching mathematics may also have some disadvantages, as it can be seen from the following table, even though not to a great extent. More precisely, teachers think that students not fully understanding the mathematics behind button pushing (M=3.63, S.D.=1.737), that graphic calculators do not promote higher thinking and a meaningful understanding (M=3.55, S.D.=1.713), that students become too dependent on the graphing calculator and are thus unable to master mathematical manipulations on their own (M=3.53, S.D.=1.640) and that graphic calculators need to be checked with mathematical reasoning (M=3.52, S.D.=1.633).

Table 7. Disadvantages of using graphic calculators in teaching mathematics

	N	Mean	Std. Deviation
Students become too dependent on the graphing calculator and are thus unable to master mathematical manipulations on their own	83	3,53	1,640
Graphic calculators need to be checked with mathematical reasoning	83	3,52	1,633
With the constant use of the graphing calculator some math skills are unused and then forgotten	83	3,47	1,626
Students are not able to think enough using a calculator	83	3,30	1,673
Graphic calculators threaten basic skill development	83	3,33	1,668
Graphic calculators do not promote higher thinking and a meaningful understanding	83	3,55	1,713
Students not fully understanding the mathematics behind button pushing	83	3,63	1,737

6. Discussion

6.1 Teachers' perceptions towards the use of technology-based tools in high school in teaching mathematics

Most of the participants in the research have attended professional development seminars regarding technology use in teaching mathematics, and thus they are enough confident in using these technologies. The teachers believe that the use of technology helps students to understand mathematical concepts and improve their academic performance in this lesson. This is similar to what Beauchamp (2011 and Orlando (2013) have found. An interesting finding of this research is that teachers tend to use technology-based tools in teaching mathematics as a reward for students, in the individual instruction for better students, but not in the individual instruction for weaker students and in the case students work in small groups. This means that teachers perhaps do not believe that technology-based tool can enhance students' interaction, as other researchers (Beauchamp, 2011; Orlando, 2013) do.

6.2 Frequency and purposes of using graphics calculator in high school

Most of the participants in the research have attended professional development seminars regarding graphics calculator use in teaching mathematics. Perhaps this explains the fact that the majority of the teachers rated its skills in using this technology as advanced, and that they use graphics calculator for about 4-5 years, on a monthly basis. The research indicated that students use graphing calculators in their classes, but they have to bring their own calculators. Only in some cases the school provides each student with his/her own calculator. Perhaps this indicates the lack of equipment in the schools regarding this technology, due to lack of financing. At the same time, this may be an indication that high schools in Thessaloniki are not fully aware of the benefits of this technology, especially on behalf of principals.

Teachers claimed that students use graphics calculators mostly in the case of classroom tests, for conceptual understanding and problem solving. Again, graphics calculators are used in teaching mathematics as a reward for students, in the individual instruction for better students, but not in the individual instruction for weaker students. On the contrary, compared to the technology-based tools in general, teachers use them in students work in small groups, but not for collaborative learning.

6.3 Advantages and disadvantages of using graphics calculator in teaching mathematics in high school

The primary advantage of using graphics calculators in teaching mathematics helps students to gain an in depth understanding of the mathematical concepts, makes the lesson having more fun, motivates students, while it also help students to save time from demanding calculations and sketching. These results coincide with the findings of previous researchers, regarding the advantages of graphics calculators in teaching mathematics in terms of making the lesson funnier, saving time, and understanding the difficult and complex mathematical concepts (Kamarulhaili&Sim, 2005; Jones, 2005; Ocak, 2008; Tan et al., 2011; Tan et al., 2013). On the other hand, however, teachers think that the use of graphics calculator cannot promote higher thinking and meaningful understanding, so that students may not be able to master mathematical manipulations on their own. Again, these results do not contradict the results of previous studies (Margaritis, 2003; Ocak, 2008), concerning the disadvantages of using graphics calculators in the classroom for teaching mathematics.

Overall, the results of the present research indicated that graphics calculators are used from teachers in the high schools in Thessaloniki as a reward for students and in the individual instruction for better students, but not for collaborative learning. This technology-based tools motivates students, saves time from making complex mathematical operations, and helps students to gain an in depth understanding of difficult mathematical complex, due to the connection between these concepts and their graphic representation.

The results of this study coincide with the outcomes of previous study, adding on to the existing body of knowledge regarding the benefits of using graphic calculators, and I general technology-based tools, in mathematical teaching. With the increasing adoption of graphics calculators in Greece, teachers and students will acquire an increased understanding of their advantages, which would result in their wider adoption from the schools in Greece. The professional development of teachers concerning the use of technology-based methods/tools in mathematic teaching is essential, and it can partly explain the frequency of using graphic calculators in the classroom and the benefits of their use, as supported also by Bennison and Goos (2010).

6.4 Limitations and suggestions for future studies

The major limitation of this study, however, is that the sample comes from a specific Greek region, and thus the results of this study cannot be generalised. Therefore, a further research, to a larger sample of high schools units from all the regions of Greece, is needed, so as to have more accurate and reliable results. Even though this study focused only on the perceptions of mathematic teachers in Thessaloniki, a first impression about the situation in Greek schools regarding the use of graphics calculators in mathematical teaching can be obtained.

Apart from this, from the literature review it became apparent that use of graphic calculators in mathematics teaching leads towards increased student achievement (Dimock&Sherron, 2005; Jones, 2005; Mesa, 2008; Tajuddin et al., 2009), primarily becauseit makes the lesson more fun and thus it motivates students and increase their interest in the lesson (Tan et al., 2011; Tan et al., 2013). Nevertheless, this was beyond the scope of this research. Hence, a future study could examine the impact of using graphics calculators on students' academic achievement, based on real-case scenarios of solving mathematical problems, or based on their scores in classroom tests, where they are mostly used. At this case, it would be very interesting to conduct a comparative study, which would examine the opinions and perceptions of students and teachers. This study would yield interesting results, since it would allow us to examine the similarities and differences in students' and teachers' opinions, regarding the use and its benefits and difficulties of graphics calculators.

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APPENDIX: QUESTIONNAIRE

1. Gender

Male	
Female	

2. Age

Up to 30 years old	
31-40	
41-50	
Over 50 years old	

3. Years of experience

0-5	
6-10	
11-15	
15-20	
Over 20 years	

4. How confident do you feel in using technologies in teaching mathematics?

Not at all	Little	Moderate	Enough	Much	Very much

5. Have you attended professional development seminars regarding technology use in teaching mathematics?

Yes	
No	

6. To what extent do you think that the use of technology in teaching mathematics (1=not at all, 2=little, 3= moderate, 4=enough, 5=much, 6=very much)?

	1	2	3	4	5	6
Technology helps students to understand concepts						
Technology makes sophisticated concepts accessible to students						
Technology helps students explore unfamiliar problems						
Technology improves student attitudes towards mathematics						

7. Please indicate the frequencies of technology use in the following teaching modes (1=not used, 2=once in 6 months, 3=once in 3 months, 4=once in a month, 5=once a week, 6=more than once a week).

	1	2	3	4	5	6
Teacherdemonstrations/lectures						
Students work in small groups						
Studentsworkindividually						
Cooperativelearning						
As a reward for students						
Individual instruction for weaker students						
Individual instruction for better students						
Students use graphics calculators to check their working and answers						
Students use graphics calculators to do more challenging questions						
Students use graphics calculators as a research tool						

8. Please rate your current level of graphics calculator skills.

Beginner	
Average	
Advanced	

9. Have you attended professional development seminars regarding graphing calculators use in teaching mathematics?

Yes	
No	

10. Do students use graphing calculators in your classes?

Yes	
No	

11. For how many years have you used graphing calculators with your classes?

Less than 1 year	
1-3 years	
4-5 years	
6-10 years	
Over 10 years	

12. How often do students use graphing calculators in your classes?

Daily	
Weekly	
Monthly	

13. How are graphics calculators made available to the students in your classes?

	Yes	No
Students are required to provide their own calculators		
The school provides each student with his/her own calculator		
The school provides teachers with a classroom set of calculators		

14. In which of the following ways do students use graphics calculators in your classes?

	Yes	No
Homework		
ClassroomTests		
ClassWork		
StateAssessmentTests		

15. For which of the following purposes do students use calculators in your classes?

	Yes	No
Operations		
ProblemSolving		
Practice		
ConceptualUnderstanding		

16. Please indicate the graphic calculators use in the following teaching modes.

	Yes	No
Teacherdemonstrations/lectures		
Students work in small groups		
Studentsworkindividually		
Cooperativelearning		
As a reward for students		
Individual instruction for weaker students		
Individual instruction for better students		
Students use graphics calculators to check their working and answers		
Students use graphics calculators to do more challenging questions		
Students use graphics calculators as a research tool		

17. To what extent do you believe that using graphic calculators for learning maths helps your students to understand maths better?

Not at all	Little	Moderate	Enough	Much	Very much

18. To what extent do you believe that using graphic calculators for learning maths helps your students to gain an in depth mathematical concept?

Not at all	Little	Moderate	Enough	Much	Very much

19. To what extent do you believe that using graphic calculators for learning maths makes the lesson more fun?

Not at all	Little	Moderate	Enough	Much	Very much

20. To what extent do you believe that students enjoy the lesson using graphic calculators for learning maths?

Not at all	Little	Moderate	Enough	Much	Very much

21. To what extent do you think that the use of graphic calculators have the following advantages for students (1=not at all, 2=little, 3= moderate, 4=enough, 5=much, 6=very much)?

	1	2	3	4	5	6
The graphing calculator provides graphical representations						
The graphing calculator helps students to save time from demanding calculations and sketching						
The graphing calculator allows students to explore mathematical properties						
The graphing calculator motivates students						
The graphing calculator aids investigations and explorations by students						
The graphing calculator provides accurate answers						
The graphing calculator illustrates graphs more clearly						
The graphing calculator helps students in their discussions in the lecture/tutorial room						
The graphing calculator stimulates and inspires students to realize their potential and learn important mathematical ideas and skills without feeling frustrated or miserable						
The graphing calculator fosters learning and thinking by providing immediate feedback						
The students get to interact with both the teacher and their classmates in the lecture/tutorial room when I use the graphing calculator						
The students can read and interpret values better with a graphing calculator						
The students understand the lessons better when using graphing calculator compared to merely using the textbook						

22. To what extent do you think that the use of graphic calculators have the following disadvantages for students (1=not at all, 2=little, 3= moderate, 4=enough, 5=much, 6=very much)?

	1	2	3	4	5	6
Students become too dependent on the graphing calculator and are thus unable to master mathematical manipulations on their own						
Graphic calculators need to be checked with mathematical reasoning						
With the constant use of the graphing calculator some math skills are unused and then forgotten						
Students are not able to think enough using a calculator						
Graphic calculators threaten basic skill development						
Graphic calculators do not promote higher thinking and a meaningful understanding						
Students not fully understanding the mathematics behind button pushing						

The Effects of Economic Crisis in Greece

Abstract:
Greece is a beautiful country, sunny, with enviable landscapes and amazing islands for summer holidays. Greeks.... A people proud, fighter, handsome, smiling and carefree! And suddenly everything has changed.

Economic crisis! "Two words which mark everyone and everything! The people lose their pride, fighting spirit, beauty, smile! The country becomes, "ugly and dark," as if the sun is gone. The economic crisis is affecting the lives of all. From 2009 to 2016, Greece continues to be in a very critical turning point in its history.[1]Not the Greeks but the lenders, "Troika", the "institutions" rule.

The Greek crisis which has broken out is multidimensional. It is an institutional, political, and social crisis. The lenders impose a tough fiscal policy which affects the social, economic, political and labor rights of the Greeks and radically changes the socio political map of the country.

Tsioni Irene[2]

[1] Athena Zoniou-Sideris, Athens university professor in a lecture on "The Greek educational reality in times of economic crisis: a critical review"

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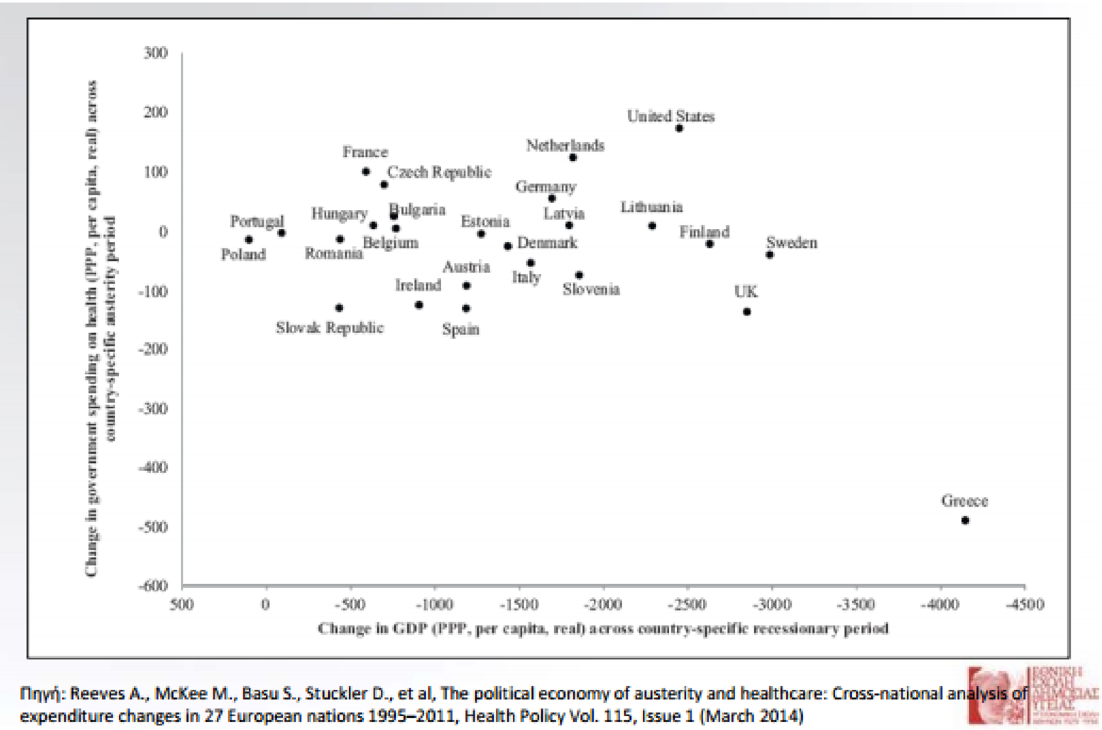
1. Economic Crisis and Health

The economic crisis creates serious problems to the financing of health services. This results in burdening the functioning of public health care units due to increased demand. The hospitals are characterized by shortages of basic necessities, basic materials for surgery, cleaning agents and shortages of essential drugs. There are also many deficiencies in consumable materials, which are not adequately provided and the situation is worse in supplies in microbiology laboratories which sometimes practically cannot operate. There are even no painkillers, injections and patients are forced to purchase them by themselves. Gauze is nonexistent, alcohol, drugs and heating as well. There is damaged and abandoned electronic equipment. Dramatic is the lack of available beds in Intensive Care Units (ICU), resulting in dozens of patients, critically ill, remaining intubated in common wards, their admission to ICU pending, and many serious regular surgeries are postponed due to lack of available beds in Intensive Care Units.

Figure 1: Change in the per capita gross product and public expenditure on health in times of economic austerity.



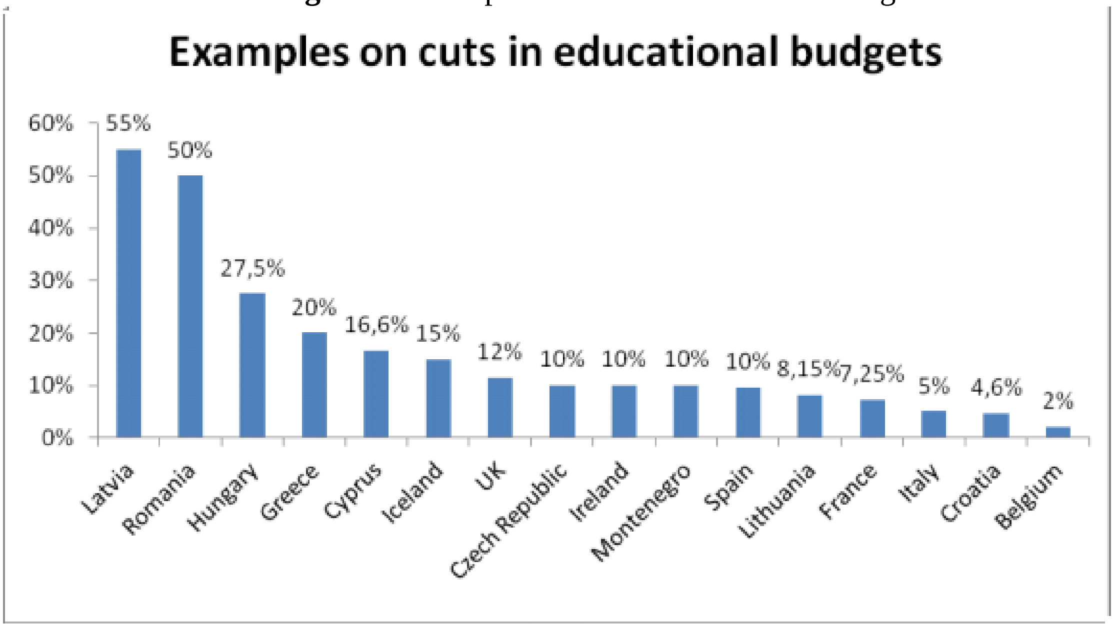
Source: Reeves A. McKee M. Basu S, Stuckler D.et.al, The political economy of austerity and healthcare: Cross-national analysis of expenditure changes in 27 European nations 1995-2011, Health Polisy Vol 115 , Issue 1 (March 2014)

The situation reminds Third World countries. Patients are hospitalized in corridors. Doctors and nurses are required to care for disproportionately large numbers of patients, since new recruits have been frozen. There are many surgical waiting lists that grow longer even for cancer surgeries.[3] The pharmaceutical industry, in which the Greek state owes tens of millions of dollars, avoids supplying the hospitals. Pharmacists on the other hand are asking to be paid in cash - especially for providing expensive anticancer drugs - even from members of the public Sector patients since they doubt that they will ever be compensated by the Public funds. The pressures on health budgets threaten basic services such as vaccinations. There are fears that many Greek children will not be able to receive quite basic and much needed health vaccines.

2. Economic Crisis and the Education

Training and education are in great decline. Drastic cuts are made in the annual budget, many mergers and abolitions of schools. The schools do not have money to meet their needs such as heating, school supplies and cleaning products. The heater burns for a few hours resulting in school buildings being cold from 11 onwards and particularly in the all-day school. Students show a decline in the learning performance as a consequence of poverty that characterizes their families. There is lack of interest in the subjects since the daily lives becomes more and more difficult. Many of them come to school without food. Teachers Associations of schools are trying to find solutions to their problem. The Ministry of Education is unable to take drastic measures and the local church helps, in turn, as best as they can.

Figure 2: Examples on cuts in educational budgets.



Source:"Daily" Greek Economic newspaper. No. EQUALITY. 19 287, Monday, May 28, 2012

[3] John Kyriopoulos MD, MSc, MPH, PhD, Department of Health Economics National School of Public Health National Public Health School of Corfu, April 2014

As we can see from the graph in 22 countries cuts have been made in expenditure for education from 2008 to date as a result of the economic crisis.

Meanwhile, at the administrative and scientific level, 50 educational organizations have been eliminated, among them the Organization of School Buildings and the School Book Publishing Organization, transferring part of the activities to private operators. In the field of higher education, the budget and administrative staff is reduced for universities by 50%, while many university departments are abolished or merged. There are serious consequences on the salaries of teachers at all levels of education.[4]

Reductions in many cases reach ¼ of their salary depending on their seniority. As a consequence, there is reduced drive for work and concern for the future of their job reduces job satisfaction . In recent years there have been no appointments and huge gaps are covered with substitutes. Expenditure on education is constantly declining and schools remain upright because of the struggle of teachers. Teachers and professors enter their classes without any joy.

3. Economic Crisis and the Markets

The Athens Stock Exchange Market was marked by the crash of 1999. On September 17, 1999 the general index of the stock market reaches its peak in 6355 points! A year and a half ago, on March 1998 it stood at 1400 units. The bubble of the stock market was the large bay plundering of thousands of retail investors who believed in abundant and uncut wealth. Thousands of ordinary and ignorant people who deposit their savings in whatever shares the experts say are conned. Suddenly after September 1999 it starts plummeting and entraps huge numbers of small investors who cannot sell their shares because they were worthless! A dramatic fall in stock prices is recorded with the market "reaching" the lowest level since the end of June 2012, falling below the levels of 600 units. This incredible nominal increase of wealth was imposed arbitrarily since there was no analogue real wealth production which was bound to break out as a crisis. From then on until 2016 the Greek stock market continues to be in a deep trance.[5]

Construction is the big loser of the six year economic crises. After the country's accession to the euro and the generous loans from banks on favorable terms, the construction industry flourished during the early years of the decade of 2000 and was reinforced by the

[4] Dimitris Vagianos, Nikos and Kostas Meghir Vettas, (2010), "The economic crisis in Greece: Reforms and opportunities at a critical juncture, www.greekeconomistsforreform.com

[5] G. Soros., (2009), "Plan for Economic Recovery", To Vima, Inset Economy pp.6-7

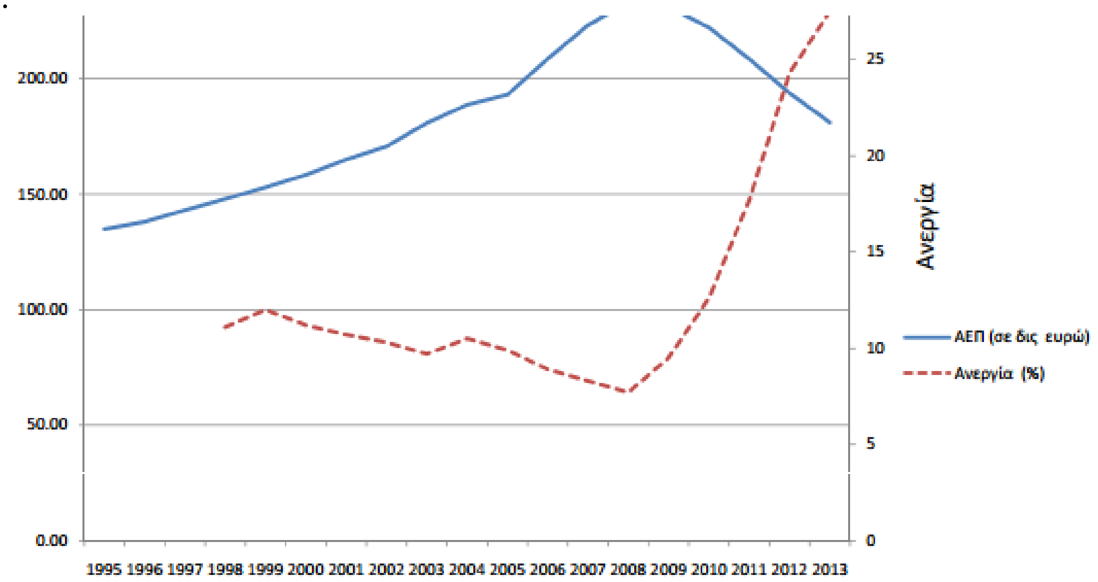
construction of Olympic projects. All this until 2007. However, the global financial crisis and then the Memoranda and construction activity literally collapsed. The collapse of this structure is responsible for a significant proportion of the large increase in unemployment. On the other hand, hundreds of businesses closed in Greece and thousands of workers are literally on the street. Unfortunately, the Greek economy continues to move inside a tunnel after about 7 years and 3 memoranda!

4. Economic Crisis and the Unemployment

Since the beginning of the economic crisis in Greece in 2009 the real income of the Greeks is reduced by 25%, while one in four is unemployed. Every Greek family is experiencing a sense of loss of job and fear for the future. Thousands of small businesses close daily throughout the country. A typical example is what is happening in the center of Athens. Once the shops there were full of work with many workers and now it is no man's land. Few shops remain at the center of the capital and 50% of employees who worked as assistant's in stores was fired and are on the dole. According to the latest forecasts of the specialists, unemployment is expected to rise. Workers are desperate at the specter of unemployment.[6]

Increase in unemployment rates is officially recorded in Greece, 12.4% (October 2010), by the Greek Statistical Office. The rising unemployment already outlines a quite difficult situation.

Figure 3:nemployment trends in Greece for the period 1995-2013



Source:John Kyriopoulos MD, MSc, MPH, PhD, Department of Health Economics National School of Public Health National Public Health School of Corfu, April 2014.

[6] INE-GSEE (2008), "The Greek economy and employment", Annual Report Athens

People are desperately looking for a job even for meager salary. Job loss and unemployment have an impact on repayment of loans charged to Greek households. Today they have launched home loans that are considered "red" and that their owners are unable to pay. Followed by consumer loans are also many, corporate loans and payments of credit cards.

The result is the Greek immigration to countries mainly in Western Europe. It is the solution that opens the wings for a better future for young people. Many of them finished a school or university and see that the only way to find a job is abroad. But in this way a whole generation of Greeks may be lost!

5. Economic Crisis and the Effect of Criminality

The links between the economic crisis and crime are tight. The financial crisis will exacerbate existing problems and existing situations. People cannot survive, lose work, home loan, family, possession and become penniless. Theft is a way of escape and survival. They steal to eat, to get dressed, to live. In particular, in times of crisis and recession, there is strongly increased crime. Unemployment cuts in wages and pensions, along with rising tax burdens of households, are oppressing, pushing people who are exposed to loans and other credits.[7] The biggest problem the society is going to face is the increase in crime especially in poor households, who face unemployment and reduced income. The thefts both in stores and in homes have increased. The killings of people especially the elderly motivated by their money is a common phenomenon. On the other hand petty theft and shop lifting in supermarkets and food stores are numerous on a daily basis.

6. Economic Crisis and the Family Effects

The economic difficulties brought about fights and these in turn problems. The crisis shakes several marriages in Greece and many couples do not withstand the test, so there is a boom in the number of divorces.

Others choose the temporary separation against the divorce for reasons of economy. The loss of a job or worse of both spouses brings family life upside down. It changes their daily lives, they do not go out, they do not have fun, they have anxiety, fights, arguing to the

[7] Reeves A. McKee M. Basu S, Stuckler D.et.al, The political economy of austerity and healthcare

expenses of the family. The existence of a loan for a mortgage and credit cards waiting to be paid makes things worse.[8]

Few families survive under these conditions. Many see that the only way out of this stuff is a divorce. A key role is played by the amendment under which the marriage is solved in one rather than two sessions, reducing costs and eliminating the margin of six months, which "traditionally" was given to the couple to reconsider. The current economic situation directly affects the institution of marriage.

7. Economic Crisis and the Demographic Effects

The financial crisis causes new data on the formation of a family, as the births have declined dramatically, which, combined with increased life expectancy, makes scientists talk about aging of the population. The Greek family is going through a difficult transition period as far as the child is concerned. Where once the characteristic of the Families was the existence of two or three children, now hardly anybody considers a second child. The births are decreasing while experts characterize the past decade as the worst demographics period since 1940. The death index coincides with the birth rate. The consequence of all this is the aging of the country. Coupled with the financial crisis aging brings significant problems to the health system and the social security system.

8. Economic Crisis and the Psychological Effects

The difficult economic conditions in Greece have psychological effects this recent period. Individuals not only face pressure in their work but also in their social life. The economic crisis as a phenomenon is a loss of confidence and security since everything changes and is uncertain. The sense of loss is intense. Feelings of anxiety, shame, personal inadequacy prevail. People get anxious, get easily angry, they feel insecure and guilty. These feelings are more obvious and intense in men and women aged 45 to 55 years. All this can lead people to use substances such as alcohol. The consequence of this is poor concentration, increased violence and crime. Finally a prolonged situation may lead the person to mental disorders such as depression.[9]

Job loss especially when it happens suddenly, as in a period of economic crisis, can affect people negatively. People who lose their jobs initially are in a state of shock. In addition to the depressive reactions of people yet another consequence is absurd job search

[8] John Kyriopoulos MD, MSc, MPH, PhD, Department of Health Economics National School of Public Health National Public Health School of Corfu, April 2014

[9] . Bouras and Lykouras, (2011), "The economic crisis and its impact on mental health," Brain, pp.55-61

behavior. The worst outcome of all the above is suicide! The crisis leads to a significant increase in the rate of suicides, which is always associated with an increase in unemployment. Unemployed persons and entrepreneurs, who suffered bankruptcy, commit suicide. Of course all these aforementioned mental effects vary from person to person and from culture to culture.

9. Economic Crisis and the Tourism Effects

Tourism is now one of the most important economic sectors for many countries worldwide. The crisis had important implications for all economic and business sectors of tourism. So daily significantly reduced tourist packages from other European countries are booked .The Greek islands that sometimes "sunk" by foreign tourists in recent summers know tourist recession. The difficult economic conditions along with the uncertainty on the eve of the country in the euro pushed tourists away.

Also the speculation about a GREXIT and the instability with existing political conditions which was marked by strong protests in central Athens creates ugly country profiles. An important factor in the amount of bookings and tourist packages destined for Greece is the negative publicity received by the country by the international media. Additionally rumors of an anti German feeling that pervades the Greek people and cultivated by some international press worsens the already bad image of the state.

10. Economic Crisis and the Design Effects

The crisis has indeed affected the shopping of the youth. The new data on the economy bring change in the way we deal with the shopping. It takes a little more searching, good communicators and confidence in youth, initiatives and creative people. In the market more and more stores appear that offer innovative solutions that do not burden the financial budget to cover the needs in clothing and footwear while enrich the wardrobe with designer and vintage clothes.

The exchange and purchase of second-hand clothes in recent years and the onset of the crisis is gaining consumer preference. The clothes which have their own history are given away or sold at very affordable prices and are preferred as a key response to the economic crisis and the pinched price of clothes of "the box." It is cheap, it is environmentally friendly as it prevents the extensive buying of clothes, they are varied but unique, excite the imagination and creativity to dress combinations while not bound to shrink.

11. Conclusions

The economic crisis has many adverse effects on individuals and society, and especially in the lower economic classes who are asked to survive in conditions increased poverty. It has settled permanently in the country. It leads to social exclusion, especially young people who are seeking escape in migration and temporary support by family and friends.

But Greeks have proven over time that they work better under pressure and come together when facing a common enemy, such as wars. So they should unite against the common enemy which is the economic crisis. The economy is the enemy, it is the problem to be solved and must be solved rather than by the Greeks themselves and not by the "institutions", the "Troika" and "Creditors".

The Greeks themselves have to change their mentality towards many issues which led to the crisis, such as tax evasion. It is necessary that they should change the opinion of foreign investors and the opinion of other European countries towards them. The Greeks themselves have to change and to 'learn' to survive despite the difficulties to escape from the dark tunnel of the crisis, finding other alternative, bright and promising ways! -

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The Impact of Economic Crisis on the Performance of Greek Companies

Abstract

Background: The financial crisis in USA in September 2008 had a negative impact on the economies of many countries around the world. Economic crisis in each country depends on its economic organization, structure, needs, problems and special characteristics

Aim: The aim of this article is to study the impact of economic crisis on the performance of Greek companies.

Methods: Bibliographic search via electronic bases of data has been conducted from 1990 to 2015, such as Pubmed, Medline and Google Scholar, using key- words such as economic crisis, world economic crisis, economic crisis and Greek business. Articles were studied, 13 articles in Greek and English language and referred to the subject, which illustrate the multilayer dimension of economic crisis.

Results: Economic crisis is the result of economic imbalance and the decline of economy because of unpredicted and unexpected facts, which may be national or international such as economic and administrative problems, corruption ineffective tax system, and inability of the country to pay its debt and find funds, high rate of unemployment or natural disasters

Conclusion: Innovation and research and development tend to be important for the expansion of GDP and exports in the period after the crisis.

Key-words: economic crisis, world economic crisis, economic crisis and Greek business

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1. Background

The financial crisis in USA in September 2008 had a negative impact on the economies of many countries around the world. Economic crisis in each country depends on its economic organization, structure, needs, problems and special characteristics. In order to deal with economic crisis, we have to take all the above mentioned into consideration .Financial crisis changed and turned into economic crisis when banks reduced credit to companies in their attempt to retain their capital sufficiency and assets.

Economic crisis drastically changed market in which companies are established, produce and grow. It is a fact that companies are under pressure to adjust to the circumstances. They are forced to reduce cost, revise their policy, investments, their business activities or even resort to mass dismissals. In this complex environment with rapid changes and high insecurity it is imperative for companies to continue being active.(Erol ,Apac, Atmaca&Ozturk 2011)

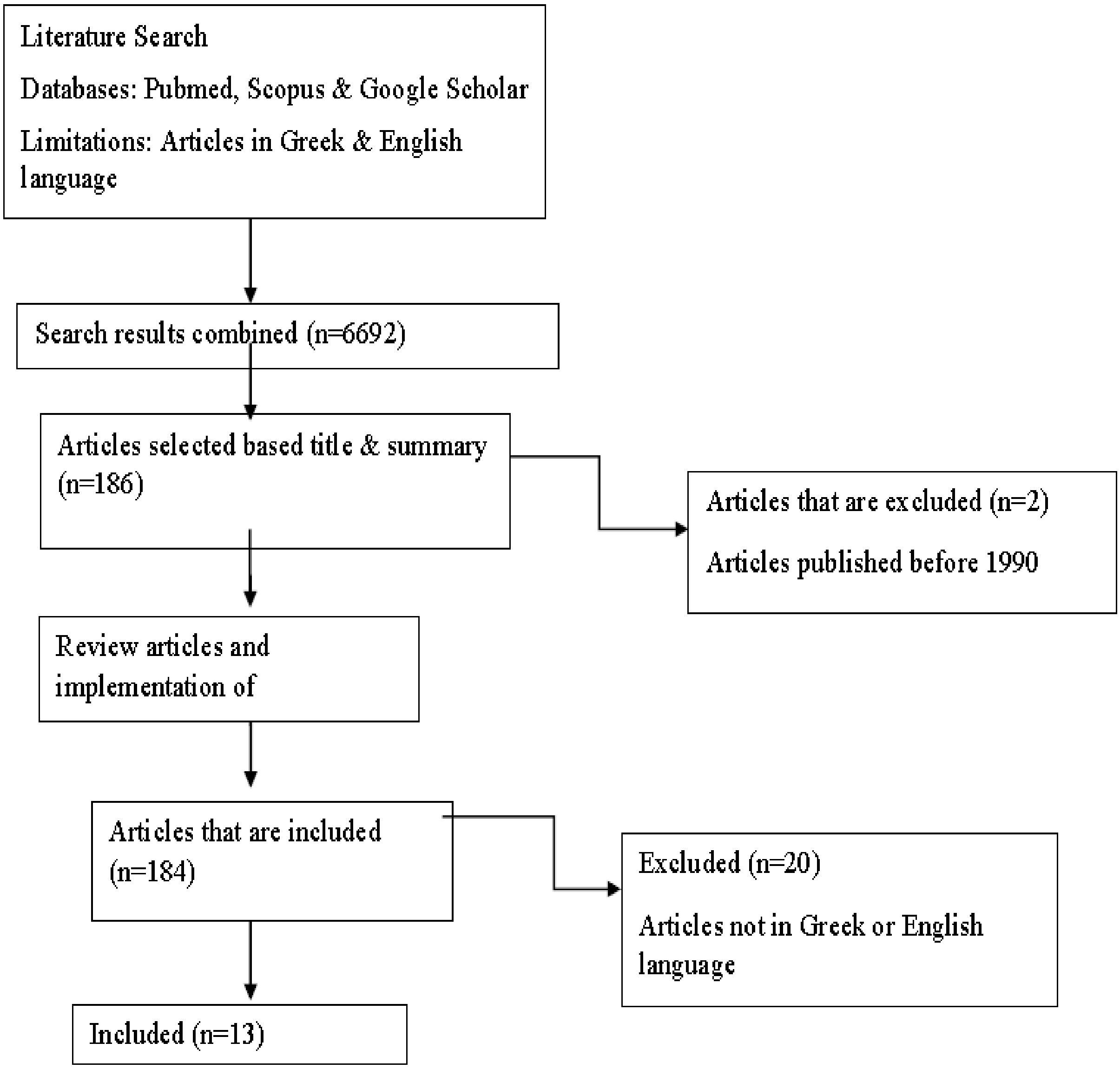
2. Aim

The aim of this article is to study the impact of economic crisis on the performance of Greek companies. It attempts to show how economic crisis affected companies and how companies reacted in order to avoid bankruptcy.

3. Methods

Bibliographic search via electronic bases of data has been conducted from 1990 to 2015, such as Pubmed, Medline and Google Scholar, using key- words such as economic crisis, world economic crisis, economic crisis and Greek business. Articles were studied, 13 articles in Greek and English language and referred to the subject, which illustrate the multilayer dimension of economic crisis. Flow-chart 1

Flow chart 1: Articles sample selection for the systematic review



4. The Results

Economic crisis is the result of economic imbalance and the decline of economy because of unpredicted and unexpected facts ,which may be national or international such as economic and administrative problems ,corruption ineffective tax system ,inability of the country to pay its debt and find funds, high rate of unemployment or natural disasters.(Erol ,Apac, Atmaca&Ozturk 2011).

The consequences of economic crisis may be disastrous for a developing or developed country. Generally economic crisis may result in

- lack of liquidity for banks and companies
- difficulty in granting loans
- reduced profit
- mass dismissals
- high unemployment rate
- reduced production
- bankruptcy of companies
- increase of the deficit
- high debt

The financial crisis started in USA, the most important financial system and stock market in the world. After the bankruptcy of Lehman Brothers on 15/10/2018 the world financial system became unstable, stock markets crashed, properties devaluated and the banking system collapsed. Crisis influenced USA real economy and the rest of the world, trade, investments, sales, job positions and standard of living.(Chardouvelis, 2009).

International financial crisis influenced Greek economy also. It is not effective to consider international financial crisis as an excuse for the Greek economic crisis (Chardouvelis, 2009).

5. Discussion

International financial crisis revealed the deficiencies of Greek economy that have existed for a long time, over indebtedness of Greek Public sector and inability to control national dept. Greece lost its credibility and could not participate in the international stock markets. State and individual investments declined substantially (Ulrich, Rogovsky & Lamotte 2009). Competitiveness was reduced, due to dept and over consumerism, in the public and then in the private sector. Public dept grew substantially and the state resorted to taxation to pay expenses, salaries, and dept.

Apart from crisis, dept and deficit Greece is not competitive anymore and faces high rates of unemployment .Compared to other EU countries there are no investments from abroad, productivity is reduced and opportunities for employment diminish. Greece economy is unable to offer opportunities for employment especially to young people and to women. There is also law rate of manpower mobility which makes it hard ,for people who look for employment for the first time, to find a job. The recession results in unemployment ,which according to official statistics is 17%.(Ulrich, Rogovsky & Lamotte 2009).

World financial crisis impeded world financial growth. This fact leads to reduction in demand of goods, services, and industrial products. Companies are forced to adjust to these circumstances by reducing cost, revising their business policy, investments and activities (Ulrich, Rogovsky &Lamotte 2009).

There are huge consequences. Companies do not employ people and fire large numbers of employees. World financial crisis changed drastically market in which companies operate. Economic crisis threatens companies, their activities and destroys their productivity.(Vergileil Tuz,2004).

The consequences of crisis were extensive regardless of the size ,the place it was established and the kind of the company .The kind of crisis that companies are faced with can be defined as 'the unexpected and unpredictable strain that demands quick reaction and threatens the existing values ,goals and affairs of the organization ,rendering the existing methods of prevention and adjustment insufficient".(Ozdevecioglu,2002).

In this turbulent economic environment companies are faced with the urgent need of taking measures in order to survive .Generally the problems companies are faced with during economic crisis are linked to sales decline, cost of raw materials, collecting money owed, limited credibility in order to take out loans .Companies, that act decisively and have a strategy, react more effectively to a potential economic crisis than unprepared and panicked ones. The fastest and more effectively, a company responds to the economic crisis, the better for its reputation, credibility, marketing activities,(Callaway &Keen 1996).

Bibliography shows that seldom does crisis start without a warning. According to Callaway & Keen, early detection of warning signs, preparation and prevention are factors that influence the way in which a company deals with crisis. Detection of warning signs presupposes realizing that economic crisis is possible to happen and conscious efforts are made to reveal these warning signs .The main goal is to be prepared to handle the existing economic crisis and prevent a new one (Callaway &Keen 1996).

According to articles published, economic crisis was widely predicted by international markets but the intensity and the degree to which it spread could not possibly be predicted .Most of the companies had more or less time to prepare for this crisis .Moreover companies and managers had already dealt with different kinds of crises the previous years .As a consequence they had already put into practice and established their strategy in order to overcome difficult economic circumstances.

Most of the companies have a plan in case they happen to face circumstances of high economic insecurity .Most of them, though, are not well prepared to deal with such a situation. A relevant research (Peen, Schoen & Berland, 2009) revealed that 53% of the companies have a plan to overcome a potential crisis, though many of these plans prove to be inadequate. However, companies without a plan are expected to suffer greater income loss and will be forced to dismiss more employees than those which are well prepared. Companies with a crisis plan react immediately and they are expected to recuperate faster. This is an advantage compared to their competition. Generally speaking usually only big companies have an economic crisis plan. Smaller companies without a plan are more vulnerable. To conclude The more prepared a company is the better it faces the economic crisis (Banerji, McArthur, Mainardi &Amman, 2009).

Many researches try to answer questions such as "What actions should companies take in order to be strong after recession". Some of them showed that a large number of companies do not take the necessary steps of action.Indeed a large number of companies does not take advantage of the opportunities economic crisis offers. There are many explanations for this inactivity .People were shocked by the speed of the recession, momentarily they were unable to take proper action .Some executives may have expected to collect more data first ,in order to construct a plan of action ,hoping that recession will prove to be less serious than they anticipated. Leaders of powerful companies probably did not wish to be the first to take bold action or act hastily. Regardless of the reason, the conclusion is that many companies do not take proper steps to find a way out of economic recession. These steps include realistic evaluation of business environment, the place of the company in this environment, choosing the appropriate strategy and put it into practice in an effective way.(Banerji, McArthur, Mainardi &Amman,2009).

However, there are researches of the same period (Raghavan,2 009)which showed that companies reacted to economic recession as expected. Almost all companies reduced cost, regarding travel expenses, communication, salaries and they even fired employees, with a view to face expected reduced sales and lack of credit from banks. Many of the companies used recession as a motive to expand, by taking advantage of new opportunities and by attracting more customers and clients. (Raghavan, 2009).

Smaller companies fight to overcome economic recession and this is obvious by reduced sales and production (Correa, Iootty, Ramalho, Rodriguez-Meza & Jang, 2010).Regarding their decisions concerning technology, a substantial percentage of companies kept on reducing attempts on research and growth/development. In fact during the examination of the real effects of recession ,an important variable to analyze is expenses on technology. However since June 2010 in most countries the number of companies planning to increase expenses on R&D was greater than the number of those planning to decrease it. This is encouraging as new technology, research and development/growth are important for GPD growth and exports after recession (Correa, Iootty, Ramalho, (Rodriguez-Meza & Jang, 2010).

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The Greek Economic Crisis: Lessons and Prospects

Abstract:
Even though Greece is facing a crisis, we could turn this situation into our advantage if certain scientific fields, that are expected to turn Greece into a competitive and considerable force, are reinforced and, thus, help Greece return to the developed European economy. The fields where we will concentrate on are Medicine, Pharmaceutics, Production of drugs from herbal substances, Archaeology, Tourism, Energy and the fields of research and innovation.

This specific article discusses the possibility for our country to have a competitive advantage over other countries, especially in this era of financial crisis that countries all over the world face. With this article we will attempt to suggest innovative ideas that come from different scientific departments, so that development that is sustainable will once again be made possible in our country.

Initially, we will focus on scientific fields like Medicine and Pharmaceutics in which our country holds a prominent position due to the specialized knowledge it provides as well as the highly skilled educational staff it has. In addition, we will concentrate on the production of medicine made from plants and herbs that abound in our country and are potentially the best way to create medicine without the addition of chemicals but straight from the "pharmacy of Nature".

It would be an omission if we didn't mention the field of Archaeology since Greece is a country of particular archaeological interest. Dealing with and upgrading the said fields, as we will see later, will yield huge financial benefits and will contribute to the economic development of our country.

Tourism also holds an important position. Tourism can prove to be a potent and exploitable tool for our country with its unique geographic features and strong historic, traditional and cultural heritage which can be used by the Greek government advantageously.

In addition, we will also focus on energy since, firstly, Greece is blessed with sunny weather almost twelve months a year and can benefit from that. What's more, there are not only natural deposits of oil and coal in our territory but Greece is also a crossing for the transport of oil and gas. These are all considerable benefits economically speaking.

Last but not least, we must not forget about research and innovation and we must concentrate on important inventions that were conceived and created in our country by Greek scientists and that provide solutions to chronic problems that can be overcome. In addition, as a result of these innovations, new products are created that not only make our everyday lives easy and help vulnerable groups of people, but they also offer a fresh perspective that may be the basis for further research, development and creation.

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1. Introduction

During the last decade, our country, Greece, reached a turning point in its modern history as the economic policies of the previous decades led Greece to a near bankruptcy. However, this impeding bankruptcy can be averted and Greece can see development again on condition that important economic reforms are enacted and enforced consistently. These reforms are not only necessary for the payment of the debt in full, but for the long-term development and welfare of Greece as well.

2. Financial crisis and the Greek economy

Even though Greece is amid a financial crisis it would be possible to have some advantages as long as the onus is put on specific scientific areas that are expected to make Greece a competitive country and at the same time a country that matters so that it can be reintegrated to the developed European economy. The areas where we will focus on are medicine, pharmaceutics and production of medicine from herbal substances as well as, archaeology, tourism, energy, research and innovation.

3. Greek economy and the development process

To be specific, we will begin with the scientific field has its roots in our country. As is well known, Greece has laid the groundwork for Medicine beginning with Hippocrates. Greek medical schools are regarded as some of the most renowned of this particular field and provide a plethora of knowledge to Greek students that turn out to be accomplished scientists who excel in Greece and abroad. It is not a coincidence that the quality of education that is provided is such that offers future doctors the opportunity to stand out and to hold important positions in the medical field abroad. Prospective doctors from a variety of countries will have the opportunity to study in the Greek universities and learn from the best.

Let us not forget that Greek doctors stand out as they use new and innovative medical practices not only in the field of artificial insemination but also in the field of plastic surgery and treatment for patients that suffer from chronic renal failure.

Therefore, upgrading of University Medical Schools along with infrastructure works such as ultramodern equipment for medical research laboratories will create the appropriate conditions so that our country will stand out and emerge as the modern Mecca of Medicine and a global medical destination.

At the same time, conventions and international exhibitions should be organized where specialized medical knowledge will be shared among scientists from all over the world and by attracting this kind of tourism a large amount of money will be obtained.

Of course, to achieve all the above, a series of measures is required. Measures that are related to the infrastructure and the development of institutional framework so that the organizers of conferences and exhibitions will have all the help they need and quality will be ensured. Therefore, excellent organization and tourist service are necessary in order for tourists to have an amazing experience and to choose our country among others again in the future.

The second scientific sector where we will concentrate on is Pharmaceutics. We all know that Pharmaceutics courses draw attention from a plethora of candidates. In order to be accepted to a Pharmaceutical school you need to score really high which suggests that there is severe competition. Even though pharmacists have guaranteed professional rights, they face a heap of problems. That is because most graduates from pharmaceutical schools choose to have their own pharmacy. Lack of specific laws involving the creation of new pharmacies has led to saturation of the sector as pharmacies now are more than what is demanded (1028 residents/pharmacy).

Taking into consideration the data we have, it becomes clear that Pharmaceutical graduates should make a step away from selling medicine and into the stage of creating medicine. As we can understand, one of the fields of economy which has strategic advantages is that of the pharmaceutical industry and in particular the field of production of pharmaceutical and chemical products for medicinal purposes. The field of pharmaceutical production is of crucial importance, as it offers added value to the national economy. The Greek pharmaceutical industry features characteristics of a potent field for the Greek economy and it could contribute significantly to the new growth model of our country.

A basic condition for the survival and sustainable development of the national pharmaceutical industry is stability of the business environment. Therefore, a simple and enforceable framework of drug policy (pricing, distribution, compensation) must be created. At the same time, the Greek pharmaceutical industry ought to maximize synergies with other fields of health as well as new complementary sectors which will allow business planning and development of investment initiative.[2]

[2] http://www.newsbeast.gr/greece/ekpaideusi/arthro/534355/prooptikes-kai-provlimata-sti-farmakeutiki and http://www.hba.gr/5Ekdosis/UplPDFs/sylltomos14/489-508%20Travlos-Emmanouilidis%202014.pdf

In addition, the production of drugs from herbal substances shows a lot of promise. Specifically, the development of organized farming of medicinal plants will be advantageous for Greece because of the climatic and geological conditions. A substantial effort in this direction could lead to the development of Greek technology as well. In Greece there are very few pharmaceutical products (ιδιοσκευάσματα) that contain active ingredients of vegetable origin, while the products that are prepared in Greek plants are based on imported raw materials. This situation can easily change bringing multiple profits to our country.

It is an undeniable fact that plants are historically the most important source of new pharmaceutical substances, despite the huge progress regarding the chemical composition of new drugs. Using natural ingredients as pharmaceutical substances is of a huge economic interest, particularly if it involves a country that has great biodiversity because of the singularity of its climate and soil. It would be wise to mention that there are over 6,500 species of medicinal plants in Greece, 1,500 of which are endemic. At the same time, countries – superpowers like Germany with an area that is three times larger has 2,700 species and 6 endemic ones, while England with double our area has 1,550 species with 16 endemic ones. As is easily understood, Greece has a comparative advantage regarding cultivation of medicinal plants.

At the same time, the modern market trends mostly deal with the production of organic herbs and medicinal plants. Since consumers are becoming more and more interested in products that rely on organic farming, according to the protocols of sustainable development and combined with the added value that is attributed to them, the appropriate conditions for investments that our country should take advantage of are created.

Everything that is mentioned above, combined with the capacity to produce products of high quality sound like a promising prospect for the development of this particular field.

In order for our country to be able to claim and hold a big share of the European and global market, we must produce a certified propagating material that will preserve its high quality and that will appear strong against foreign herbs and medicinal plants.[3]

Another field that is equally important is the development of educational institutions and scientific fields like Archaeology. This scientific field in combination with the excavations that are available on this land because of its archaeological wealth has a lot of prospects. The students who study at these particular institutions will have an advantage as they will be given the chance to be trained on significant archaeological findings that abound in Greece. As a result, there will be multiple advantages since they will be visited by a large

[3]http://www.kathimerini.gr/788899/opinion/epikairothta/politikh/paremvaseis-ston-tomea-farmakeytikwn-fytwn

number of students from all over the world and they will be an incentive for the would-be archaeologists of the future.

Apart from seeing it from the educational perspective, that is, attracting students from

Europe and the rest of the world, archaeology will bring financial benefits over time by displaying and presenting antiquities to the general public.

Greece with more than 16,000 kilometers of coastline and over 6,000 islands has consolidated its position in the global market of tourism. Greece is in great demand as far as summer vacations is concerned, but it is also ideal for thematic tourism all year round. Its competitive advantages are natural beauty, geographical diversity and a rich cultural heritage. These advantages reinforce its image both as a universal touristic destination and as a travel market with a lot of opportunities for investments.[4]

Despite the financial crisis, tourism in Greece has been one of the main fields of development and contributed remarkable to the job market, with a continuous increase in revenues and tourist arrivals. This was accomplished with the upgrading of tourism products and the development of important markets for Greece like Turkey, Israel, Russia and China.

At the moment the tourism industry focuses on prolonging the tourist season, on attracting tourist groups of a higher value, on increasing the average revenue per visitor and on making Greece accessible to more markets. Of course, in order for the strategy of upgrading the tourist industry to succeed, our country must not only enrich classic tourism (sun and sea) but also develop the sub-sectors of tourism such as maritime tourism, city tourism, cultural and religious tourism, medical tourism, conference tourism and resorts. In addition, it must develop specialized products and infrastructure in various categories (for instance, gastronomy, well-being, luxury, culture). Entrepreneurs should also be given incentives, so that they can go forward with the construction of luxurious tourist resorts that will target different demographic groups, and, finally, tourist and transport sectors that belong to the state must be privatized.

Recently the Greek energy system has shown steady increase of the energy consumption due to the economic development and the changes in consumer behavior. There’s been a high consumption of fossil fuels and mainly lignite as this particular fossil fuel was strategically chosen to produce electric energy after the oil crisis in the 70s. We have also been depending on a large volume of imports that included mostly unfiltered petrol, petroleum products and natural gas which was recently imported but at the same time there

[4] http://www.enterprisegreece.gov.gr/default.asp?pid=36&sectorID=37&la=2and http://www.hba.gr/5Ekdosis/UplPDFs/sylltomos14/489-508%20Travlos-Emmanouilidis%202014.pdf

has been gradual development of renewable energy sources and improvement of energy efficiency as a result of adopting European policies and requirements[5]

According to what has been mentioned we conclude that this specific field contributes to the Gross Value Added of the country, while we expect that there will be significant development in the coming years thanks to the following factors:

The required optimization of the energy mix, the national privatization program, the liberalization of electricity and natural gas markets, the capability of Greece to evolve into a European gas and petrol transit gate, the improvement of energy efficiency and cost savings and finally the interconnection of the Greek islands.

All the above show that Greece has all that is necessary and can gain a competitive advantage for the following reasons: its geographical position since it is a crossroad between East and West, its productive capacity because of the mild climate and its unexploited production potential – mainly in the sector of renewable sources of energy and with the help of the government through the support of large investment projects and the reforms of the legislative framework in order to propel important opportunities for investments as mentioned above.

Last but not least, we have the sector that gives Greece an advantage and that is the sector of research and innovation. Our country offers first class education to students since it has some of the most renowned university schools and scientifically trained students graduating from these schools. As a result, there are a lot of innovations as we speak.

Some of these innovations are the following:

- *WatchAngel***.** It was created by a group of ITE of Crete. WatchAngel is actually a portable medical device, in the form of a bracelet, that records and analyses accurately heart rate, respiratory rate, the percentage of oxygen in blood, body temperature and blood and systolic pressure of the user. What makes it special is that it allows the accurate measurement of the vital parameters of the user, throughout the day and night without interrupting him go about his daily business. What's more, this is the first time that a 'smart' device measures blood pressure and at the same time warns of any possible dangers based on the measurements. With this device the research group focuses on older ages that have chronic medical conditions and require continuous monitoring. This is achieved with a mobile phone application that not only informs but also specifies where the patient is located in case of an emergency. It is worth mentioning that WatchAngel can be used by anyone even if they are not familiar with technology and that it could contribute to the reduction of hospitalization of

[5] http://www.enterprisegreece.gov.gr/default.asp?pid=36&sectorID=38&la=2

the patient and of course to the reduction of its cost. What is more, it contributes to the decongestion of the health system and the improvement of remote treatment and monitoring for people who live alone for long periods of time or who live in remote areas (e.g. islands) and are at great risk.[6]

- *The vaccine against multiple sclerosis* that hopes to provide therapy for thousands of people. It is a global patent created by a chemistry professor and his team from the University of Patras. Testing of the active substance is being conducted in lab animals for many years and has been successful. What remains to be done now is clinical testing which will be conducted in a clinic in Australia by a Greek researcher with the support of a big Greek pharmaceutical company.[7]
- *Seatrac* is a ramp of 15 meters with a depth of 80 centimeters that consists of a chair that moves on solar power and a waterproof remote control. Controlling is very simple as it has only two buttons, one for the sea and one for the land. Seatrac was the idea of a person with disabilities and the purpose of its construction is easy autonomous access to the sea by people with disabilities without the help of other people or their families. So, a team in the Applied Mechanics Laboratory of the Department of Mechanical and Aeronautical Engineering of the University Of Patras undertook the implementation of the idea.[8]
- *Geomiso* is the first "two in one" worldwide fully integrated software that can be used both as a design program and as a software simulating engineering projects. Geomiso can easily and quickly design engineering projects of highly complex geometries with a wide spectrum of applications (care, ship, aeroplane, construction) while studies more efficiently and with increased accuracy their behavior (distorted situation, endurance check). Geomiso is both for engineers, naval architects, civil engineers and for architects, designers, graphic designers. It is a powerful research tool for the academic community (computational geometry, computational mechanics) as well as a powerful technological tool for the professional community of engineers, while at the same time it covers a wide range of

[6] http://www.cretanmagazine.gr/eidiseis/creta/eidiseis-creta/pagkosmia-efevresi-apo-pente-kritikous-pou-sozoun-zoes/

[7] http://www.enallaktikos.gr/ar22194el-patrinoi-epistimones-patentarisan-to-prwto-pagkosmiws-emvolio-gia-ti-sklirynsi-kata-plakas.html and https://www.alfavita.gr/arthron/epityhia-patrinon-patentaran-1o-pagkosmios-emvolio-gia-ti-sklirynsi-kata-plakas

[8] http://www.dimokratianews.gr/content/10463/%CE%B7%CF%80%CE%B1%CF%84%CE%AD%CE%BD%CF%84%CE%B1-made-greece-%CF%80%CE%BF%CF%85_CE%B4%CE%AF%CE%BD%CE%B5%CE%B9-%CE%B1%CE%BD%CE%AC%CF%83%CE%B1-%CE%B2%CE%BF%CF%85%CF%84%CE%B9%CE%AC%CF%82-%CF%83%CF%84%CE%B1-%CE%B1%CE%BC%CE%B5%CE%B1 and (http://www.neolaia.gr/2012/09/01/upatras-kainotomos-rampa-gia-ta-amea/

applications (automotive industry, aircraft construction and defense, industry of consumer products, biomechanics). The specific software was created by a Greek civil engineer.[9]

- *Accessibility Pass* is an international certification standard for hotels, ranking them according to their accessibility since its aim is to provide all the necessary information so that people with disabilities (cognitive, motor, visual, hearing) as well as elderly people can be helped find a suitable room according to their needs. The certification standard «Accessibility Pass» was developed by the Greek certification body PEOPLECERT in cooperation with the Center for Research and Technology (IMET/EKETA) and with experts on accessibility issues internationally and experts on the elderly.[10]

- *'Prognosis' smartphone application* was created by a group of students in the Aristotle University of Thessaloniki and helps diagnose early symptoms and improve the life of patients with Parkinson's disease. This technology helps record data of the user's interaction with the device (such as the change in the voice). If it notices anything that looks alarming, the application urges the use to visit his doctor. Since this application's aim is to improve the patient's quality of life the interventions proposed were formed based on the patients' needs and requirements. In fact, the inventors were first in contact with patients and doctors and located the problems that they face. A common problem that a Parkinson's patient faces is that at any given moment, even as they walk their brain may stop giving the command for continuing the walk involuntarily. So, in order for the person to recover a stimulus is required. By connecting the application to a wristband makes it possible for the application to understand when the Parkinson's patient stops walking and by reproducing a vibration and a beep to the patient's wrist may render him able to continue walking again. Furthermore, it locates instantly any disruptions the patient may have during sleep. By producing specially designed sounds (binaural beats) to hearing aids that the patient is wearing, brain coordination may be achieved as well as conditions of calm sleep.[11]

- *Acropolis Rock* is a modern application that was created by two engineers. It allows visitors from abroad or even from Greece who use this application to have the city of Athens on our phone or tablet. It offers visitors of the archaeological site a new, fresh experience by adjusting its content according to the age and interests of the user. By providing video, photos of high quality and 3D representations, the tour turns into a live journey that connects the visitor of the present to the glorious past of the site. Moreover, it provides information for the

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[9] http://www.ert.gr/larisa-pagkosmia-kenotomia-se-logismiko-schediasmou-kathista-perizitito-stin-evropi-lariseo-michaniko/.

[10] http://www.voria.gr/article/parousiastike-to-accessibility-pass-gia-ta-atoma-me-eidikes-anagkes.

[11] http://www.protothema.gr/technology/article/497251/dipli-pagosmia-diakrisi-gia-tin-ellada-sto-microsoft-imagine-cup/

archaeological site, opening hours and cost of tickets. The application suggests restaurants and places of entertainment and thus helps the local market, while at the same time it offers access instructions for any part of the city either by car or by public transport. What's is worth mentioning is that it's not necessary to have internet access and there are no other extra costs.[12]

- *P.E.ACE (Portable Evasive AssistanCE)*, is a student's invention. P.E.ACE is actually special glasses for people with visual disabilities. The specific glasses have ultrasound sensors that is vibrations and sound stimuli with which the user is notified if there are any obstacles on his way and the exact direction of his head.[13]
- *The electronic glove* is a high school student's invention who came up with the idea by observing a member of his family having difficulty moving his hand and not being able to pick up things. The electronic glove weighs only 350 grams which makes it especially easy to use. The glove is actually a metal construction that is placed around the hand. The construction has pressure sensors that perceive any effort that the user who wears the glove makes to move his hand. Then, with the help of a processor that is integrated on the glove, the glove gives – with the help of algorithms – command to the motors to be activated. According to the manufacturer this glove can give the hand the ability to lift up to 17 kilos (each joint).[14]
- *Clio Muse* began an extensive procedure of developing customers. The initiators of this idea began, with the help of questionnaires they had prepared, asking passers-by, visitors of museums and exhibition centers and came to some conclusions as to what exactly the needs of their customers are and then constructed Clio Muse application which is an application that has narrations about art and culture. It has a lot of short, factual, valid stories about each exhibit and there are even references of funny facts that are related to the exhibits. In addition, the application gives the user the chance to choose the number of stories they would like to see, share with others, vote for them and save them to their favorites. It works as a means of promotion for other exhibitions so the user is notified through a digital magazine the application has. What's more, it works as an evaluation tool for their exhibitions through statistics that arise from the users' activity[15]. At the moment the application has information about the exhibitions of the Athens City Museum, the Liquid Art House gallery in Boston, USA, the Greek Gastronomy Museum, a pivotal exhibition about the Acropolis that links the ruins with the New Acropolis Museum, the exhibition of the Dutch Embassy and the

[12] http://www.lifo.gr/articles/digital-media_articles/78089
[13] http://www.imerisia.gr/article.asp?catid=31205&subid=2&pubid=113343040
[14] http://www.lifo.gr/now/greece/19464
[15] http://www.huffingtonpost.gr/2015/03/03/startupgreece-clio-muse-efarmogi_n_6778672.html)

Ambassador's Residence. Furthermore, an action by atenistas called the Open Walk Athens 4 was also included on "Small Museums of Athens" in November 2014. The application is available in two languages, English and Greek as mentioned above.

4. Conclusions

Taking into consideration all the above, we are in the position to claim that our little country, Greece, has all the guarantees to have a comparative advantage over competitive countries. Greece must seize to be known as a country that provides services only. As far as the sector of research and innovation is concerned, Greece has already accomplished a lot and it can accomplish even more. By taking correct actions, Greece could give a boost so that it will be able to take full advantage of its products for a better future not only for the Greeks but for Europe and the whole world as well. Our country can become equal if not better than other countries if the appropriate prerequisites and proper planning exist as well as zest and love so that this land can thrive and hold the position that it deserves in the modern global economy and history.

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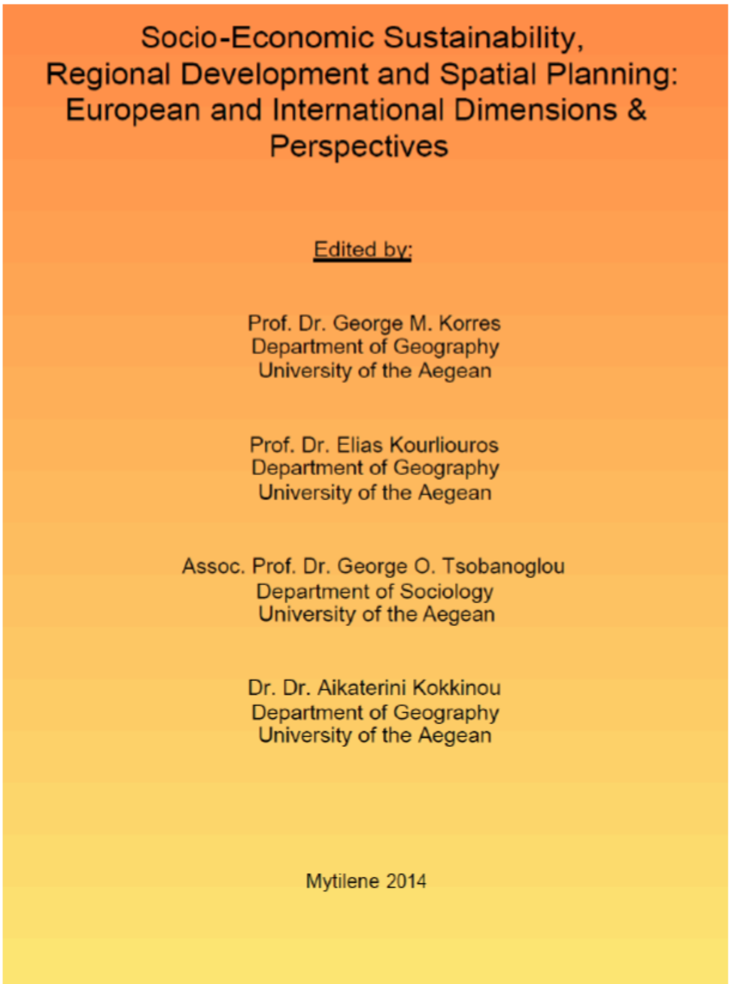

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